Vol. 2, Nos. 2-3 *Rauwolfia Number* April-July 1959

PAKISTAN JOURNAL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Published by

PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
KARACHI

Remember!

A new, more powerful and really effective way to

banish all insects

Shelltox with dieldrin

the strongest and most persistent insect-killer ever!

It's good news for *you*... but bad news for Flies, Bugs, Mosquitoes and other household nuisances! New Shelltox contains the new wonderful SHELL Insecticide DIELDRIN-the strongest and most persistent insect-killer ever known. You simply paint or spray NEW SHELLTOX on floor, skirting boards, walls, window ledges etc. *and for a long time after, it's sudden death to any insect crawling there.* In normal, economic doses NEW SHELLTOX kills, and goes on killing longer than any insecticide you have used before. It's just as effective too, as spray against flying insects Buy NEW SHELLTOX with DIELDRIN today.

Fixed Retail Price Rs. 4/10/-

Available from all leading stockists and **BURMAH-SHELL** *dealers.*

In case of difficulty please contact:

N. FUTEHALLY & CO., (KARACHI) LTD.

D-86 S.I.T.E., MANGHOPIR ROAD, KARACHI-16. Phone: 79817 Cables 'FUTEHCHEM'

Gadoltex

PAKISTAN JOURNAL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Vol. 2, Nos. 2-3 | *Rauwolfia Number* | April-July 1959

CONTENTS

Foreword 79

Studies in the Alkaloids of Rauwolfia Serpentina, Benth. and the Mode of Their Occurrence ..... Salimuzzaman Siddiqui, S. A. Warsi and M. Alauddin 80

Studies in the Ajmaline Series ..... Salimuzzaman Siddiqui, S. A. Warsi, M. Alauddin and Viqaruddin Ahmad 86

Pharmacological Investigation of Serpajmaline, an Alkaloidal Factor of Rauwolfia Serpentina ..... R. Deininger 93

The Pharmacology and Toxicology of Serpajmaline ..... K. J. Child, B. Davis, Helen M. Sharpe, E. G. Tomich and R. Deininger 99

Antifibrillant Action of the Serpajmaline Complex and its Constituent Alkaloids ..... R. Deininger 114

Culture and Propagation of Rauwolfia Serpentina, Benth. in East Pakistan ..... S. Hedayatullah 118

Bibliography on Rauwolfias ..... A. R. Ghani and Akhtar H. Siddiqui 123

WORTHY OF YOUR TRUST

Albert David

PHARMACEUTICAL PRODUCTS

ALBERT DAVID (PAKISTAN) LTD.

DACCA
POST BOX 20

KARACHI
POST BOX 4589

Pakistan Journal of Scientific and Industrial Research

EDITORIAL BOARD

Salimuzzaman Siddiqui,
D. Phil. Nat., M.D.
Director, Scientific and Industrial Research
(*Ex-Officio Chairman*)

Col. M. K. Afridi, M. D., D.T.M. & H.
Vice-Chancellor, University of Peshawar,
& Director, North Regional Laboratories,
Pakistan Council of Scientific and
Industrial Research, Peshawar

Ali Ahmad, Ph.D., D.I.C.
Technical Director, Pakistan Industrial
Development Corporaton, Karachi

Taskhir Ahmad, B.Sc. (Agr.), Ph.D.
Director, Department of Plant Protection,
Karachi

M. Innas Ali, M.Sc., M.E.E., Ph.D.
Head of the Department of Physics,
University of Dacca, Dacca

M. O. Ghani, M.Sc., Ph.D.
Agricultural Development Commissioner,
East Pakistan, Dacca

Mazhar-ul Haque, M.D.
Professor and Head of the Department of
Pharmacology, Dow Medical College,
Karachi

S. Hedayatullah, M.Sc., Ph.D.
'Al-Kahf,' Tejgaon
Dacca

Q. M. Hussain, M.A., Ph.D.
Dean, Faculty of Science,
University of Dacca, Dacca

Karimullah, D. Phil. Nat., Ph.D.
Director, West Regional Laboratories,
Pakistan Council of Scientific and Industrial
Research, Lahore

M. Qudrat-i-Khuda, D.Sc., D.I.C., M.Sc.
Director, East Regional Laboratories,
Pakistan Council of Scientific and Industrial
Research, Dacca

M. Raziuddin Siddiqi,
M.A., Ph.D., D.Sc.,
Vice-Chancellor, University of Sind,
Hyderabad

M. M. Qurashi,
B.A. (Hons.), M.Sc., Ph.D., A. Inst. P.
Senior Research Officer,
Central Laboratories, Pakistan Council of
Scientific and Industrial Research, Karachi
(*Editor & Ex-Officio Secretary*)

M. A. Haleem, M.Sc., M.A., LL.B.
Patent Officer, Pakistan Council of
Scientific and Industrial Research, Karachi
(*Associate Editor*)

Papers should be widely-spaced, single-sided type-scripts in English, wide margins being provided to facilitate editorial instructions to the printers. Publication will be speeded if a duplicate copy accompanies the manuscript. The submission of a manuscript will be taken to imply that the material has not been previously published in any language.

Line drawings for the manuscript should preferably be 6″, 9″, 12″ wide, and be planned for reduction to the width of a single column. The drawing may be on white drawing paper or tracing cloth, and the lines should be black and reasonably broad to ensure clear reproduction. Photographic reproductions (of drawings) that conform to the above dimensions will also be acceptable. Photo-micrographic and other pictures should be glossy prints with a maximum black and white contrast. They should be rectangular in shape and should not be marred by heavy writing or paper clips, staples, etc. All drawings and photographs should carry on the back the figure number and the author's name. Figure captions should be typed and collected on a separate sheet at the end of the manuscript.

Tables should have suitable captions at the top, and should be carefully laid out with brief and self-explanatory column headings, economy being exercised in arranging the tables. Mathematical equations should be carefully printed by hand without any over-writing. Greek and other unusual symbols should be identified in the margin, thus "Greek Alpha."

References should be numbered consecutively and arranged thus at the end of manuscripts :

1. Q.M. Ahmad, Phys. Rev., **41**, 852 (1932).
2. H. Lamb, *Hydrodynamics* (Cambridge University Press, Cambridge, England, 1940), sixth edition, pp. 573, 645.

Work included in the manuscript but done by the author in other laboratories should be clearly acknowledged. Data in the form of figures or tables quoted from sources other than the manuscript should refer to the sources in the captions of the figure or table.

All proofs will be sent to the author and should be returned promptly, extensive alterations being avoided. Orders for reprints should accompany the corrected proofs.

All manuscripts and enquiries should be addressed to the Associate Editor, Pakistan Journal of Scientific and Industrial Research, 141-S/2, P.E.C.H.S., Karachi, 29.

Orders should be sent to the Associate Editor. Annual subscription, Rs. 15/- post free. Single copies, Rs. 4/- post free. Rauwolfia Number, Rs. 8/- post free.

QUALITY CHEMICALS

POTASH ALUM
NITRIC ACID
SULPHURIC ACID
HYDROCHLORIC ACID
FERROUS SULPHATE
ALUMINIUM SULPHATE
MAGNESIUM SULPHATE

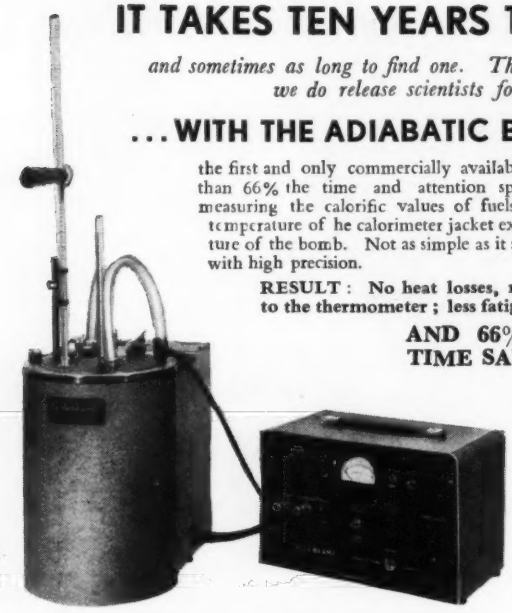
PAK CHEMICALS LTD.

HAKIMSONS BUILDING, No. 1, WEST WHARF ROAD, KARACHI
PHONE: 32901 (3 LINES) GRAMS: "DURDANA"
FACTORY: S. I. T. E., MANGHOPIR ROAD, KARACHI. PHONE: "79008"
BRANCH OFFICE: FAZAL BUILDING, COOPER ROAD, LAHORE. GRAMS: "HELPERS"

IT TAKES TEN YEARS TO MAKE A SCIENTIST

and sometimes as long to find one. Though we ourselves have none to spare, we do release scientists for really important work...

...WITH THE ADIABATIC BOMB CALORIMETER



the first and only commercially available set of its kind, reduces by no less than 66% the time and attention spent on other bomb calorimeters in measuring the calorific values of fuels and foods. The trick is to raise the temperature of he calorimeter jacket exactly in step with the rising temperature of the bomb. Not as simple as it sounds, of course. But now achieved, with high precision.

RESULT: No heat losses, no corrections, no tedious slavery to the thermometer; less fatigue, fewer sources of error.

AND 66% OF THE SCIENTIST'S TIME SAVED FOR OTHER WORK

A SCIENTIST SAVED IS A SCIENTIST MADE

And the calorimeter sets are available, not in ten years, but now, at a price at which they will pay for themselves in a matter of months.

Highest grade stainless steel
First class workmanship
Unequalled efficiency

Send for Publication 598

A. GALLENKAMP & Co. Ltd.

SUPPLY THE WORLD'S LABORATORIES

SUN STREET, LONDON E. C. 2.

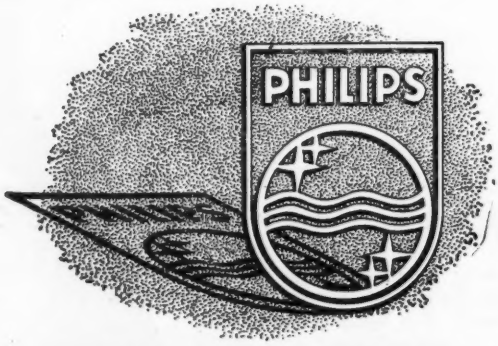
Appointed Agents:

Azam Trading Corporotion

West Pakistan:
Frere Road, opp. Bohra Jamat Khana, Karachi, 1.

East Pakistan:
52 Toyenbee, Circular Road, Dacca.

the symbol you can trust



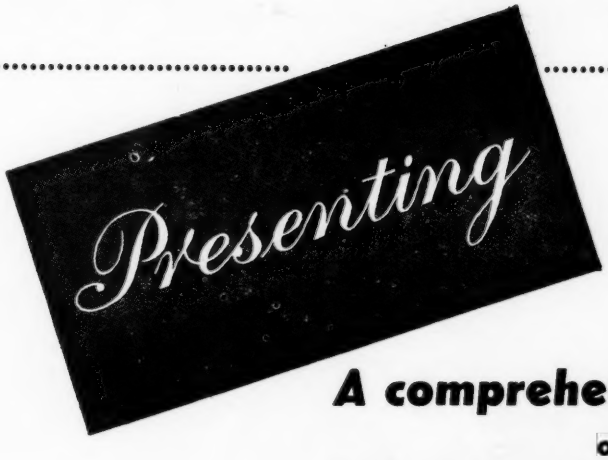
PHILIPS

FOR LIGHT, RADIO AND ELECTRONIC EQUIPMENT

PHILIPS ELECTRICAL CO. OF PAKISTAN LTD.
KARACHI LAHORE DACCA CHITTAGONG

STRONACHS

LA476



A comprehensive range of Laboratory Chemicals

INCLUDING A SELECTION OF RESEARCH CHEMICALS

4-ACETAMIDOBENZALDEHYDE · 4-ACETAMIDO-3-NITROANISOLE 2-ACETAMIDO-4-NITROBENZOIC ACID · 4-AMINOBENZONITRILE · 8-AMINO-6-METHOXYQUINOLINE · 4-AMINO-β-PHENYLETHYLAMINE AMSONIC ACID (4-4′-DIAMINOSTILBENE-2:2′-DISULPHONIC ACID) 4-CYANOBENZALDEHYDE 4:7 DICHLOROQUINOLINE · EMBONIC ACID (2:2′-DIHYDROXY 1:1′ DINAPHTHYLMETHANE-3:3′-DICARBOXYLIC ACID)

and featuring . . .

THE 'EMBAPHASE'* RANGE OF SPECIALIZED CHEMICALS OF STANDARDIZED QUALITY AS STATIONARY PHASES IN

GAS CHROMATOGRAPHY

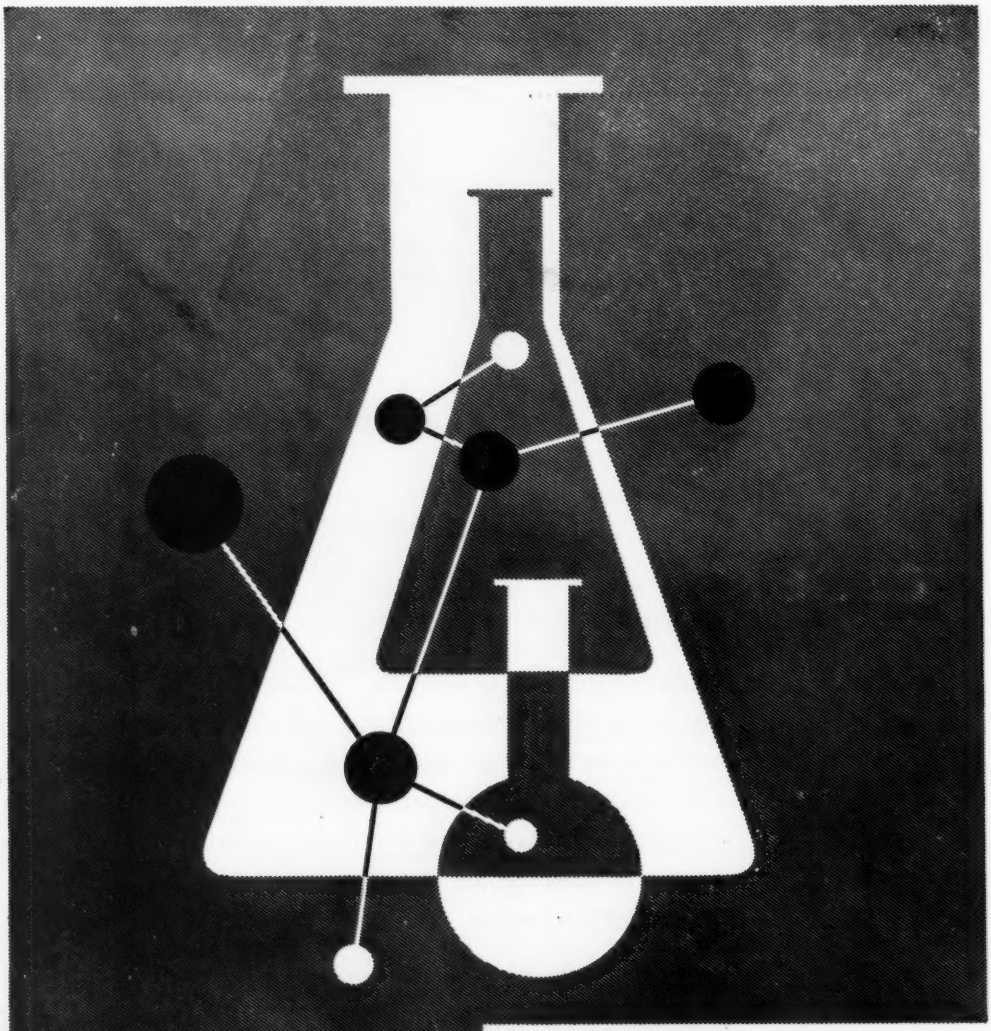
BENZYLDIPHENYL · DIMETHYLFORMAMIDE SILICONE OIL
DIGLYCEROL · DINONYL PHTHALATE · SQUALANE
and introducing 'EMBACEL'* Kieselguhr

M&B brand **LABORATORY CHEMICALS**

MAY & BAKER LTD

P.O. BOX 43 DACCA · P.O. BOX 4924 KARACHI · P.O. BOX 323 LAHORE

* *TRADE MARK*



CHEMICALS

Merck

E. Merck
DARMSTADT · GERMANY

Sole Agents in West Pakistan
ABDUL SATTAR SONS & CO.
47, NOOR CHAMBERS
ROBSON ROAD, KARACHI

Sole Agents in East Pakistan
CAPCO AZIZ LIMITED
344, JUBILEE ROAD
CHITTAGONG

BDH Laboratory Chemicals...

...are specially packed

The many different packages used for B.D.H. laboratory chemicals are designed to ensure safety, economy and maximum convenience. Polythene has revolutionized many containers; glass bottles for both solid and liquid chemicals have been redesigned, new 'closures' introduced, double-capped bottles developed to avoid volatilization losses; and brighter, more attractive labels give space for technical information, specifications of purity and warnings on hazardous materials.

There are more than 6,000 laboratory chemicals and reagents in the B.D.H. catalogue, and upwards of a thousand of them are labelled with specifications of purity.

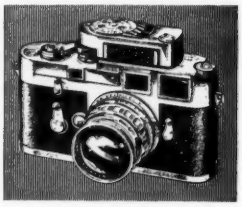
THE BRITISH DRUG HOUSES LTD

B.D.H. LABORATORY CHEMICALS DIVISION · **POOLE** · **ENGLAND**

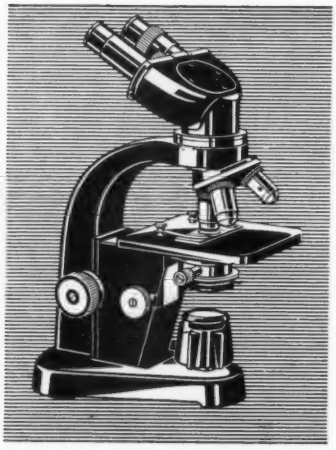
Distributors in West Pakistan
Bliss & Company
P.O. Box No. 7113, Sadar, Karachi
Telephone: 51463

Distributors in East Pakistan
Shafi & Company Ltd.
1 Wiseghat Road, Dacca
Telephone: 2629

ERNST LEITZ GMBH WETZLAR



LEITZ 35 mm camera
LEICA M 3
with Leicameter



LIETZ.
laboratory microscope SM
for monocular and
binocular observation

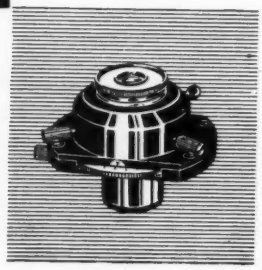
MICROSCOPE SM

the modren versatile routine microscope for monocular and binocular observation. Its most outstanding feature is the new-type single-control coarse and fine adjustment offering most accurate, convenient and rapid focusing of the microscopic image in all ranges of magnification.

Our production programme also includes:

Large research microscopes of the latest design for all fields of microscopy,
LEITZ phase contrast equipment,
Stereoscopic microscopes,
Photomicrographic apparatus,
Microtomes, infrared spectrographs,
Photometers, micro-refractometers, spectroscopes,
LEICA 35 mm cameras with supplementary equipment for scientific and technological photographic work

Leitz
WETZLAR



Sandkuehler eyepiece for counting cells in bone marrow smears or cell tissue sections.

Sole Agents in Pakistan

Messrs. ALI GOHAR & COMPANY

Serai Road,
KARACHI

Strand Road,
CHITTAGONG.

PAKISTAN JOURNAL
OF
SCIENTIFIC AND INDUSTRIAL RESEARCH

Vol. 2, Nos. 2-3 | *Rauwolfia Number* | April-July 1959

Foreword

It is a remarkable circumstance that, alongside of modern medicine, the mediaeval Graeco-Arab system known as 'Unani Tibb' (Ionian medicine), and the ancient healing system of Ayurveda continue to hold the field in this subcontinent, catering to the needs of a large majority of the population. Quite irrespective of the validity of the theories of these systems, it was realised early that there was still a lot to be learnt from their pharmacopoeial experience, and the classic work of Dymock, Hooper and Warden, 'Pharmacographica Indica,' published about the turn of the century, is a pointer in that direction. In the 1920's a concerted effort was made at the School of Tropical Medicine in Calcutta, towards the pharmacological investigation of the active constituents and isolates of a whole series of plant drugs. Subsequently, as a more purposeful approach from the point of view of the indigenous systems of medicine, a drug research institute was established at the Ayurvedic and Unani Tibbi College in Delhi, on the initiative of the late physician and statesman, Hakim Ajmal Khan. The very first drug that came up for investigation at this institute was *Rauwolfia serpentina*, which was systematically used over a long period by the late Hakim Ajmal Khan in the treatment of a variety of mental ailments, in the form of a powder with a rather appropriate name 'Dawa-ush-Shifa' (the healing draught). Following the communication on the now well known ajmaline series of alkaloids, increasing interest has been shown in the therapeutic virtues of *Rauwolfia*, and many groups of workers in the subcontinent and the world over have taken part in the various aspects of studies in the active constituents of the drug.

It is a measure of the importance *Rauwolfia* has acquired in the treatment of hypertension and as a tranquilliser in mental ailments, that starting from the first publication in 1931, the bibliography on the subject already counts over two thousand references. These references also include reviews and articles presenting the subject matter from various standpoints and interests. In the present special issue of this journal, it is not intended to cover all that ground, but rather to record the more recent contributions to studies in *Rauwolfia* carried out under the Pakistan Council of Scientific and Industrial Research. Aside of studies in the alkaloidal complexes isolated from fresh undried material, this issue also reports the results of work on the cardiac activity of one of the complexes, namely, serpajmaline, and its correlation with the chemical structure of its constituent alkaloids.

It is hoped that the material presented in this issue will stimulate further work in the field of *Rauwolfia* alkaloids, and that the bibliography included in it will also be helpful to that end.

S.S.

STUDIES IN THE ALKALOIDS OF RAUWOLFIA SERPENTINA, BENTH. AND THE MODE OF THEIR OCCURRENCE

SALIMUZZAMAN SIDDIQUI, S. A. WARSI AND M. ALAUDDIN

Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

From the roots of *Rauwolfia serpentina, Benth.*, obtained from the Bihar province of India, S. Siddiqui and R.H. Siddiqui[1] isolated in 1931* a series of crystalline bases, namely, ajmaline, ajmalinine, ajmalicine, serpentine, and serpentinine, taking advantage of the differences in their basic strength on the one hand, and the solubilities of their hydrochlorides on the other. Later, in 1939, working on the roots and root bark of the plant, obtained from the more temperate climate of the Dun Valley, S. Siddiqui[2] reported the isolation of two isomers of ajmaline, namely isoajmaline and neoajmaline, a base melting at 220°C. and, from the neutral fraction of the alcoholic extract, a white crystalline alkaloid melting at 234°C., in a yield of 0.1%. From this last mentioned base and its mother liquors it was subsequently possible through repeated fractional crystallisations from methanol and acetone to isolate a crystalline substance, which melted at 270-273°C., and yielded on mild hydrolysis an acid and a base. These findings, however, were not reported, awaiting further work on the problem which had to be held over during the War and its aftermath. In 1952, Schlittler et al.[3] reported the isolation of this base under the name, reserpine, from the so-called 'oleo-resin' fraction which actually corresponds to the 'neutral fraction' referred to above. These authors further claimed reserpine as the sole therapeutic agent in the dual role of its sedative action on the one hand, and blood pressure reducing property on the other. This claim had to be somewhat modified later on, particularly with the isolation of rescinnamine, which has similar pharmacological action.[4] The isolation of this and other minor bases subsequently reported over the years by various authors and listed in Table 1 has not however, materially affected the position claimed for reserpine in respect of its therapeutic action.

Against the background of earlier work briefly referred to above and also taking into account the conflicting pharmacological and clinical findings of various groups of workers in respect of the individual alkaloids and preparations of *Rauwolfia serpentina*, it was considered of interest to isolate and study the various alkaloidal factors as far as possible in the form they occur in the plant body. Moreover, as stocked samples of *Rauwolfia* roots were found to give comparatively low yields of crystalline bases, and profiting from the observation that the crystalline constituents isolated from fresh plant materials through dialysis with solvents can get completely destroyed on drying,[8] apparently due to enzymic and oxidative degradations, fresh undried roots of *Rauwolfia serpentina* were employed for this study.

Working on fresh roots harvested from an experimental plantation in East Pakistan, a procedure was evolved and briefly reported by Siddiqui for the isolation of a number of alkaloidal complexes,[9] on the basis of their varying solubilities in polar and non-polar solvents and expressly avoiding the use of acids, alkalies and other chemical reagents. This procedure which is described in detail in the experimental, consists in dialysing undried roots chopped into 2-3 cm. lengths with alcohol, removing the solvent from the combined dialysates, and resolving the semisolid residue into the following fairly well-defined alkaloidal factors, on the basis of their respective solubility in petroleum ether, ethyl acetate, amyl alcohol and water:

(1) A petroleum ether soluble, greenish viscous liquid, which has been named 'resajmaline' mainly consisting of fatty matter, serposterol and other unsaponifiables. It contains 2.3% reserpine, 0.5% rescinnamine, some of the other weaker bases, and traces of ajmaline (yield 0.5-0.8%).

(2) An ethyl acetate soluble, petroleum ether and water insoluble, alkaloidal complex, named 'ajmalexine' which forms a cream coloured powder consisting mainly of the alkaloids of the ajmaline group, and the weaker *Rauwolfia* bases including 5.5% of reserpine and 2.5% rescinnamine (yield 0.2–0.3%).

(3) An ethyl acetate insoluble, amyl alcohol soluble factor, designated as 'serpajmaline' which forms a light cream coloured powder and is readily soluble in water. It is chromatographically free from reserpine and other weaker bases of the group, and mainly consists of the alkaloids, ajmaline, serpentine and serpentinine, along with two unknown substances giving a greenish and an orange fluore-

* A year later, in 1932, van Itallie and Steenhauer[5] reported the isolation of a base from *Rauwolfia serpentina* which was obviously identical with ajmaline, but they named it as rauwolfine. This has been responsible for a double confusion in nomenclature, due to the added fact that the isolation of a base with that name was also reported in the same year by Koepffli as a constituent of *R. caffra.*

scence. Besides these three fairly well-defined fractions, which account for about 70% of the total assayed alkaloidal content, a comparatively small quantity of an ill-defined light brown product partially soluble in water and aqueous mixtures of amyl alcohol is also obtained in this working along with a reddish, syrupy, water soluble ballast containing about 5–10% of the residual alkaloids.

Apart from protecting the bases against aerial oxidation and enzymic degradation, a further advantage of working with freshly harvested material lies in the fact that the cell walls of the fresh roots virtually act as a semi-permeable membrane, retaining a substantial portion of the non-alkaloidal ballast, and the dialysates thus yield on removal of the solvent only 5% of a semisolid matter on air dried basis, as against 10–12% extractive from the alcoholic percolates of the air dried powdered roots, the non-alkaloidal ballast which greatly complicates the isolation work being thus reduced by about half.

In contrast to the rather long drawn out procedures which had to be adopted by Siddiqui and Siddiqui,[1] and later by Robinson et al.,[10] and other workers for the isolation of alkaloids from the alcoholic extracts of dried powdered roots, the complexes referred to above have served as convenient source materials for the various alkaloids, following a comparatively smooth and simple procedure described for their isolation in the experimental. Apart from ajmaline, neoajmaline, serpentine, serpentinine and reserpine, a base melting at

TABLE I.—ALKALOIDS FROM *Rauwolfia serpentina*.[7]

Name	Empirical formulae	M. p. °C.	First isolated by
Ajmaline	$C_{20}H_{26}O_2N_2$	158 - 160	Siddiqui & Siddiqui (1931)
Ajmalinine	$C_{20}H_{26}O_3N_2$	180 - 181	,, ,, ,,
Ajmalicine		250 - 252	,, ,, ,,
o-Yohimbine	$C_{21}H_{24}O_3N_2$	258 - 259	Weisenborn et al. (1954)
Raubasine (Alkaloid II) ..	,,	247 - 248	Popelak et al. (1953)
Alkaloid F	,,	253 - 254	Neuss et al. (1954)
Tetrahydroserpentine ..	,,		Bader & Schwarz (1952)
Serpentine	$C_{21}H_{20}O_3N_2$	157 - 159	Siddiqui & Siddiqui (1931)
Serpentinine	$C_{21}H_{22}O_3N_2$ (?)	263 - 265	,, ,, ,,
Isoajmaline	$C_{20}H_{26}O_2N_2$	264 - 266	Siddiqui (1939)
Neoajmaline	$C_{20}H_{26}O_2N_2$	205 - 207	,, ,,
Rauwolfinine	$C_{19}H_{26}O_2N_2$	235 - 236	Chatterjee & Bose (1951)
Reserpine	$C_{33}H_{40}O_9N_2$	277 - 278	Mueller et al. (1952)
Raupine .. (Identical)	$C_{19}H_{22}O_2N_2$	325	Bodendorf & Eder (1953)
Serpagine ..		over 300	Stoll & Hofmann (1953)
Reserpinine ..		238 - 239	Schlittler et al. (1954)
Alkaloid A ..		243 - 244	Neuss et al. (1954)
Alkaloid C .. (Identical)	$C_{22}H_{26}O_4N_2$	240	Hofmann (1954)
Raubasinine (Alkaloid I) ..		228	Popelak et al. (1953)
Corynanthine (Rauhimbine) ..	$C_{21}H_{26}O_3N_2$	218 - 225	Hofmann (1954 & 1954)
Isorauhimbine	$C_{21}H_{26}O_3N_2$	225 - 228	Hofmann (1954)
Yohimbine	$C_{21}H_{26}O_3N_2$	234 - 236	Bader et al. (1954)
Rescinnamine	$C_{35}H_{42}O_9N_2$	226	Haack et al. (1954 & 1955)
		238	Klohs et al. (1954)
3-epi α-yohimbine ..	$C_{21}H_{26}O_3N_2$	125 - 128 181 - 183	Bader et al. (1954)
Serpine	$C_{21}H_{26}O_3N_2$	213	Chatterjee & Bose (1954)
Serpinine	$C_{20}H_{24}ON_2$ or $C_{21}H_{26}ON_2$	315 - 317	Bose (1955)
Thebaine	$C_{19}H_{21}O_3N$	195	Hofmann (1954)
Papaverine	$C_{20}H_{21}O_4N$	147	,, ,,
Reserpiline	$C_{23}H_{28}O_5N_2$	amorphous	Klohs et al. (1954)

300-310°C. and probably identical with serpinine[11] has also been isolated in the present working.

Several batches of *Rauwolfia serpentina* roots harvested from the plantation in East Pakistan at various age levels were worked out according to this procedure with the results tabulated in the experimental (Table 2). In the course of this work it has been noted that the maturity of the roots has a considerable bearing on the yields of the various complexes. In one of the batches harvested at the end of July, very little of the fraction corresponding to ajmalexine could be isolated. Moreover, the age of the roots was also found to influence the alkaloidal content of the serpajmaline complex. Alkaloidal content of this complex was found to be about 35% in comparatively young roots and nearly 50% in the roots of about 2 year old plants.

The seasonal variations seemed to be even more significant. The dialysates of the roots harvested during the summer months, May-July, on partitioning between water and ethyl acetate did not completely divide up between these two solvents, leaving some quantity of an insoluble middle layer, which seemed to increase with the age of the roots. The roots harvested in January (about 2 years old) did not give such a middle layer under parallel conditions of working. Moreover, only neoajmaline was obtained from serpajmaline in this working while all the batches received during the summer months gave the normal isomer, ajmaline. This finding recalls the earlier observation of Siddiqui[8] that neoajmaline is formed under more temperate climatic conditions, as the principal alkaloidal constituent of *Rauwolfia*.

The fact that the major part of the total alkaloids occurs in the form of 'complexes,' rather than as simple salts or in the free state, is fairly evident from the fact that ajmalexine is insoluble in water or dilute acetic acid, but on breaking up the complex with alkali, the liberated bases readily dissolve in dilute acids. Again, in contrast to all the *Rauwolfia* alkaloids and their simple salts, the bases contained in resajmaline are readily soluble in petroleum ether, and cannot be extracted from the ethereal solution with the help of dilute acetic or mineral acids, which should point to their occurrence in the form of a petroleum ether soluble complex. The solubility of serpajmaline in amyl alcohol also leads to the same conclusion.

On the basis of fairly exhaustive studies in the pharmacology of serpajmaline,[12] which is obtained in an yield of 1.3-1.6% on dry weight basis, it has been found that it is highly potent in its hypotensive activity, without the therapeutically complicating sedative and central depressant action characteristic of reserpine and other *Rauwolfia* preparations. It has been further noted that serpajmaline has a strong antifibrillant action on the isolated heart of the rabbit and the dog.[13] On the other hand, it has very low toxicity, dosages as high as 1000 mg./kg. body weight proving non-fatal in mice.

In order to determine the role of its non-alkaloidal constituents in this cardiac action of serpajmaline, its carbohydrate component was isolated free from basic impurities, employing mildest possible methods. A nearly colourless, treacly, nitrogen-free, water soluble product thereby obtained in an yield of about 15% on the weight of the complex, was found to have the same order of antifibrillant action as serpajmaline and ajmaline. None of its individual constituents, however, quantitatively account for the total activity of the serpajmaline complex, which would appear to be derived from the mutually potentiating, synergistic action of the various alkaloidal and non-alkaloidal components of the complex. Further work on problems arising out of the findings recorded in the present paper is in progress.

Experimental

The procedure employed for obtaining the various alkaloidal complexes was basically identical with that briefly described earlier by Siddiqui.[9] Sixteen kg. of fresh undried roots of *Rauwolfia serpentina* (corresponding in dry weight to 7.2 kg.) were harvested when 21 months old from an experimental farm in East Pakistan, flown to Karachi and immediately on receipt cut into 2-3 cm. lengths and soaked in ethanol. The extract was removed after every 48 hrs. About 20 litres of ethanol (95%) was needed each time to soak the chopped roots. Each extract after removal was first concentrated in a cyclone evaporator to about 5 litres and finally *in vacuo* to a treacly mass, not allowing the temperature to exceed 50°C. The weights of the liquidish residues obtained for the 5 percolates were 750, 600, 75, 68, and 61 g., respectively. A further extraction was carried out with 80% ethanol and the semisolid mass obtained was 135 g. The extraction was considered complete as a subsequent extract with 80% ethanol gave a very small amount of the semisolid residue.

The roots were initially assayed for their alkaloidal content and then after the withdrawal of each percolate:

Initial	2.04%	After ext. IV	0.15%
After ext. I	0.99%	„ V	0.12%
„ II	0.55%	„ VI	0.06%
„ III	0.49%	„ VII	0.03%

The still liquidish residue (about 2 litres) was stirred up with water (2 litres) and shaken with ethyl acetate when the extract divided up into ethereal and aqueous layers. The lower aqueous layer was exhaustively extracted with ethyl acetate (200 ml. each time, total 1 litre) until the ethyl acetate layer was only faintly yellow. The combined ethyl acetate extracts were washed with water (100 ml., 3 times) and the aqueous washings added to the main aqueous extract.

Isolation of Serpajmaline.—The aqueous extract was repeatedly shaken out with amyl alcohol (250 ml. each time, total 5 litres) till further extractions gave only negligible quantities of residue on removal of the soevent from an aliquot fraction. The combined amyl alcoholic extract was shaken out repeatedly with water (300 ml. each time, 5 times). The aqueous extracts on complete removal of the solvent *in vacuo* below 50°C. and subsequent drying yielded a light cream coloured powder (97 g.).

The amyl alcohol was then concentrated to about half the volume *in vacuo* and again exhausted with water. The aqueous extracts were shaken out with ethyl acetate, and on complete removal of water *in vacuo* yielded a further quantity of light cream coloured residue (18 g.), making for a total yield of 115 g. (1.59%).

Separation of Resajmaline and Ajmalexine.—The combined ethyl acetate extracts were freed of the solvent *in vacuo* and to the residue (80.8 g.) enough petroleum ether was cautiously added to adequately cover the residue without stirring, and was carefully decanted off after every 48 hrs. Further extractions were similarly carried out with petroleum ether until a colourless extract was obtained, leaving practically no residue on removal of the solvent.

Resajmaline.—The petroleum ether extract on complete removal of the solvent yielded a green thick oily product (55 g., 0.76%).

Ajmalexine.—The petroleum ether insoluble residue on drying *in vacuo* gave a light cream coloured powder (24 g., 0.33%) on the weight of the dry roots.

Several batches of fresh *Rauwolfia* roots obtained from the experimental farm were worked according to the process detailed above and gave the various complexes in yields indicated in Table 2.

Serpajmaline and its Constituent Bases.—Serpajmaline is a light cream coloured amorphous powder readily soluble in water, absolute alcohol and moist acetone, insoluble in benzene, ethyl acetate, ether and other non-miscible solvents. It begins to soften at 85°C., sticks to the sides at about 100°C., and froths up around 130°C. The aqueous solutions of serpajmaline show a pH of 5-6.

Attempts were initially made to separate the stronger, yellow bases from the comparatively weaker colourless bases of the ajmaline group by extracting with immiscible solvents after adjusting the pH of the aqueous solution to 7 with dilute ammonia. This procedure of isolation, however, did not work as the complex does not seem to break at this pH.

Serpajmaline (5 g.) was treated with cold dilute 10% ammonia (2 ml.) and the yellow granular precipitate was filtered and washed with ice-cold water under suction. The aqueous filtrate was extracted thrice with ethyl acetate (15 ml.). The precipitate (2 g.) was taken up in the ethyl acetate washings when practically the whole of it went into solution leaving a negligible quantity of a dark

TABLE 2.—YIELDS OF *Rauwolfia* ALKALOIDAL COMPLEXES FROM DIFFERENT BATCHES OF FRESH ROOTS.

Harvesting period	Age	Fresh roots kg.	Calculated dry weight kg.	Serpajmaline %	Ajmalexine %	Resajmaline %
End of January 1958 ..	15 months	18.0	9.0	1.55	0.22	0.833
Second week of July 1958 ..	10½ „	14.5	8.12	1.13	0.244	0.532
End of July 1958 ..	11 „	16.5	9.075	1.123	—	0.462
First week of October 1958..	13 „	17.0	7.65	1.2	0.29	0.60
End of May 1959 ..	21 „	16.0	7.20	1.6	0.33	0.76

brownish insoluble residue. The moist ethyl acetate extract was cooled in ice and saturated with carbon dioxide, finally with the addition of petroleum ether (about 10 ml.) whereby the stronger, yellow bases were removed as carbonate, leaving a faint yellow solution. After filtration and drying over anhydrous sodium sulphate the solvent was removed *in vacuo*, the residue (1 g.) extracted with benzene and the benzene soluble fraction (0.77 g.) after removal of the solvent was crystallised from methanol. The colourless crystallisate thus obtained was identified as ajmaline. The benzene insoluble fraction on crystallisation with methanol gave colourless long needles, subliming at 300-310°C., and probably identical with serpinine[11] (m.p. 315°C.). The yellow sticky precipitate of the carbonates was completely freed of the solvent *in vacuo*, dissolved in the least quantity of 10% acetic acid, charcoaled and treated with an ice-cold aqueous solution of potassium iodide. The resulting yellowish precipitate was filtered, taken up in methyl alcohol (8-10 ml.) and kept in the cold, when glistening yellow rods of serpentine hydriodide crystallised out (m.p.278°C., decomp.). The alcoholic filtrate was again treated with activated charcoal, slightly concentrated and carefully basified with dilute caustic soda, when serpentinine almost immediately came out in lemon yellow crystals which after washing with cold dilute methanol melted at 264°C., and showed no depression in m.p. on admixture with an authentic sample of serpentinine.

In a subsequent working, the basic fraction obtained on treatment of a cold aqueous solution of serpajmaline with ammonia was directly separated into a benzene soluble and an insoluble fraction avoiding the use of ethyl acetate. A little petroleum ether was added to the benzene solution when on saturation with carbon dioxide it became almost colourless. The residue on removal of the solvent was crystallised from methanol yielding ajmaline. The precipitated insoluble matter along with the benzene insoluble fraction containing the yellow bases could then be worked as described above for the isolation of serpentine and serpentinine.

Serpajmaline complex obtained from the roots harvested at the end of January yielded only neoajmaline melting at 205-207°C.

Ajmalexine.—It is a light cream coloured amorphous powder soluble in ethyl acetate, mostly soluble in benzene fairly so in ethanol and methanol and insoluble in petroleum ether. No quite satisfactory method of isolating the individual bases from this complex could be evolved owing to the fact that the complex connot be effectively broken without treatment with stronger alkali which results in the partial hydrolysis of the weaker bases like reserpine and rescinnamine. For the isolation of reserpine, ajmalexine (6 g.) was dissolved in hot ethyl acetate (25 ml.), and the solution after quickly drying over sodium sulphate was adsorbed over a column of silica gel (E. Merck, for partition chromatography), 25 cm. long and 2 cm. in diameter. The column was first eluted with ethyl acetate until the eluate became colourless and then exhausted with methyl alcohol. The ethyl acetate extract was freed of the solvent *in vacuo*, the residue taken up in hot benzene and cooled, and the small quantity of the greenish precipitate which deposited was filtered off and added to the methanol extract. The benzene soluble fraction on removal of the solvent *in vacuo* was dissolved in a small quantity of methanol and kept in the cold when colourless crystals (0.19 g.) melting at 268-271°C., were obtained and identified as reserpine. The methanolic eluate and the mother liquor of reserpine which gave positive HNO_3 colour reaction for ajmaline were not followed for the isolation of other alkaloidal constituents for the present.

Resajmaline.—The separation of individual alkaloidal components from this lipoid soluble complex also presented many manipulative difficulties. In one of the workings, resajmaline (50 g.), obtained from comparatively young roots harvested in February, was taken up in a mixture of ether, petroleum ether and methanol, and kept in the cold. The crystalline deposit thereby obtained was repeatedly crystallised from a mixture of acetone and methanol when it finally gave colourless silky needles m.p. 155-160°C., identified as serposterol. The dark green filtrate from the original crystallisate was extracted with a mixture of methanol and dilute 10% aqueous ammonia (50:50). The petroleum ether layer was freed of the solvent *in vacuo* and was not pursued further for the present. The ammoniacal extract was acidified with dilute acetic acid to pH 6 and the solvent removed *in vacuo*. The residue gave through ethyl acetate a crude crystallisate, the ether soluble fraction of which on repeated crystallisation from methanol yielded colourless needles (m.p. 205°C), identified as neoajmaline. The ether insoluble portion of the crude crystallisate gave from methanol, on repeated crystallisation, colourless needles m.p. 250-254°C., identified as ajmalicine, by taking mixed melting point with an authentic sample.

Acknowledgement

The authors wish to record their grateful thanks to Dr. S. Hedayatullah for the periodical supplies of fresh roots of *Rauwolfia serpentina* from the experimental plantation in East Pakistan. They are also indebted to Mr. Sardar Ali Khan for his assistance

in this work, and to Dr. R. Deininger and his colleagues of the Pharmacological Section of the Laboratories for their cooperation in studying the physiological action of the various products isolated in the course of the present work.

References

1. S. Siddiqui and R.H. Siddiqui, J. Indian Chem. Soc., **8**, 667 (1931).
2. S. Siddiqui, J. Indian Chem. Soc., **16**, 421 (1939).
3. Muller, Schlittler and Bein, Experientia, **8**, 358 (1952). Full paper: Dorfman, Furlenmeier, Henbner, Lucas, MacPhillamy, Muller, Schlittler, Schwyzer and St. Audre, Helv. Chim. Acta, **37**, 59 (1954).
4. E. Haack, A. Popelack, H. Springler and F. Kaiser (Boehringer & Sohne G. m.b. H., Mannheim, Germany), Naturwissenschaften, **41**, 214-215 (1954); **42**, 47 (1955).
5. van Itallie and Steenhauer, Arch. Pharm., **270**, 313 (1932).
6. Koepffli, J. Am. Chem. Soc., **54**, 2412 (1932).
7. R.F. Woodson, H.F. Youngken, E. Schlittler and S.A. Schneider, *Rauwolfia* (*Botany, Pharmacognosy, Chemistry and Pharmacology*), (Little, Brown and Company, Boston).
8. S. Siddiqui, J. Sci. Ind. Research (India), **4**, 68 (1945).
9. S. Siddiqui, Pakistan J. Sci. Ind. Research, **1**, 3 (1958).
10. Anet, Chakravarti, Robinson, and Schlittler, J. Chem. Soc., 1242 (1958).
11. Bose, J. Indian Chem. Soc., **33**, 374 (1956).
12. R. Deininger, Pakistan J. Sci. Ind. Research, **2**, 93 (1959).
13. R. Deininger, Pakistan J. Sci. Ind. Research, **2**, 114(1959).

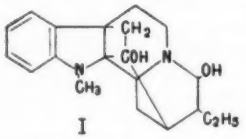
STUDIES IN THE AJMALINE SERIES

SALIMUZZAMAN SIDDIQUI, S. A. WARSI, M. ALAUDDIN AND VIQARUDDIN AHMAD

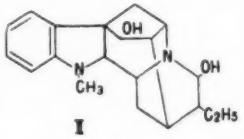
Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

Out of the various bases isolated by Siddiqui and Siddiqui[1] from the roots of *Rauwolfia serpentina*, ajmaline, the principal alkaloid, was subjected by the authors to a more detailed study.[2] In the course of this study, it was found that ajmaline contains one N-methyl group, forms neutral nitrosoamine derivative and yields a tertiary methyl base through its methiodide. A secondary character was, therefore, concluded for one of its two nitrogen atoms. The presence of an olefinic double bond in the molecule was deduced from the fact that it took two atoms of bromine in the cold, giving a product which when crystallised from alcohol melted at 230°C. (decomp.) and analysed for dibromoajmaline. On the basis of their further studies in the chemical characteristics of ajmaline and the colour reactions of the zinc dust distillation products, already reported in the meanwhile by van Itallie and Steenhauer,[3] Siddiqui and Siddiqui further suggested a structure for ajmaline closely allied to strychnine.

Following these investigations, Robinson and his associates[4,5,6,7], carried out comprehensive studies in the constitution of ajmaline and assigned to it the structural formula I which was later slightly modified by Woodward as II.[8]



I



I

In their first communication on the subject, Robinson et al. generally confirmed the earlier findings of Siddiqui and Siddiqui, but disagreed with the interpretations they put forward for some of them. These points of disagreement may be summarised as follows:—

1. Dibromoajmaline is actually bromoajmaline hydrobromide, as its aqueous solution gave precipitate on the addition of an aqueous solution of silver nitrate, and monobromoajmaline on liberating the base with ammonia.

2. Ajmaline is di-tertiary and not secondary-tertiary in character, as it yields a quaternary base through its methiodide, and the action of nitrous acid on ajmaline hydrochloride in aqueous solution gives a basic C-nitroso and not N-nitroso derivative.

3. Neoajmaline reported by Siddiqui[9] could not be distinguished from ajmaline with any certainty as its hydrochloride gave ajmaline hydrochloride on recrystallisation, and the m.p. 205-207°C. recorded for neoajmaline as against 158-160°C. for ajmaline could be considered as that of anhydrous ajmaline.

The isolation of serpajmaline and other therapeutically significant alkaloidal complexes by Siddiqui[10] from the fresh undried roots of *Rauwolfia serpentina*, followed by the observation that the serpajmaline complex besides being hypotensive in character[11] also possessed antifibrillant action[12] on the isolated heart of the rabbit and dog, revived fresh interest in the chemistry and pharmacology of the alkaloidal constituents of *Rauwolfia*. Studies in this direction led to the finding that ajmaline, the main alkaloidal component of serpajmaline, has the same order of antifibrillant action as the complex as a whole and that serpentine also has this character although to a lesser degree, while serpentinine is inactive. In view of these findings, it was considered of interest to study the relationship between the chemical constitution of ajmaline and its cardiac action. As a result of this study it has been found that the reduction of the benzene ring in ajmaline (hexahydroajmaline) lowers its cardiac activity to about 1/1000. On the other hand, methyl-, acetyl- and dihydro-ajmaline, in all of which the benzene ring remains intact, were found to be devoid of any cardiac activity,[13] establishing the fact that the dynamic isomerism of the carbinolamine and imine-aldelyde structure, $=\overset{|}{N}.\overset{|}{C}H(OH) \rightleftharpoons =NH \quad \overset{|}{C}HO$, serving as what may be described as a 'cardiophoric' grouping, is essential for the cardiac action of the ajmaline molecule, and that the benzene ring in it has only a potentiating action.

In the course of these investigations the earlier work of Siddiqui and Siddiqui (loc. cit.) on ajmaline was repeated and their conclusions re-examined in the light of disagreement expressed by Robinson et al. and referred to at the outset.

As a result of this re-examination the position may be stated as follows:—

The bromination product obtained on titration

of ajmaline with bromine in chloroform solution melts, as reported by Robinson et al. at 295°C. (decomp.), but on crystallisation from alcohol it shows m.p. 235-239°C. as recorded by Siddiqui and Siddiqui. That this variation in melting point is not due to the anhydrous state of the former is evidenced from the fact that on drying the bromo-product crystallised from alcohol *in vacuo* at 100°C., the melting point is not affected. In case of iso-ajmaline also the melting point recorded by Robinson for its bromination product is 288-289°C. (decomp.) but it has been found that on crystallisation from methanol it melts at 225-228°C.

Further, it has now been noted that, when the drop by drop addition of bromine in chloroform solution is carried on till there is a persistent turbidity, which occurs after the addition of only 1.7 atoms of bromine, and the addition product is worked up as described in the experimental, a bromo derivative is obtained which on crystallisation from methanol melts at 178-182°C. (decomp.), the melting point remaining unaffected on further crystallisations or drying *in vacuo* at 100°C. These findings suggest the formation of three isomeric bromo derivatives, of which the one melting at 296°C. is an unstable form.

The observations made in the course of the bromination studies, which were extended to a number of other derivatives of ajmaline, would appear to indicate that the carbinol amine tautomeric grouping induces a potential olefinic double bond in the complex ring system of ajmaline, presumably at the expense of the bridge ring provided in its structure by both Robinson and Woodward. This could account for the formation of a chloroform soluble, dibromo addition product from which HBr is secondarily eliminated, yielding a monobromo, chloroform insoluble hydrobromide, which on treatment with aqueous ammonia yields monobromoajmaline. This view gets a measure of support from the fact that dihydroajmaline fails to give a bromo derivative, and that secondary elimination of HBr from bromine addition products of bases containing an olefinic linkage has been reported earlier, e.g. in the case of the conessine series of alkaloids.[14] The fact that hexahydroajmaline is saturated to bromine would only show that the reduction of the benzene ring stabilises the bridge ring, rather than constitute an argument in favour of a straightforward bromine substitution reaction at the aromatic centre, under the experimental conditions of the reaction.

Again, methylajmaline, in which the carbinol-amine grouping is eliminated and the aldehyde group stabilised, takes up nearly 3 atoms of bromine, giving an amorphous powder which melts at 290°C., is difficultly soluble in water and gives a bromine-free product on liberation with aqueous ammonia, which could be identified with methylisoajmaline through its hydriodide (m.p. 195°C.; methylajmaline hydriodide, m.p. 129-131°C.). The formation of such a loose bromo compound might be explained by the enolisation of the aldehydic carbonyl of the base from which bromine is completely eliminated on treatment with ammonia, methylajmaline being converted into methylisoajmaline in the process.

In re-examining the alternatives of secondary or tertiary character of one of the two nitrogen atoms of ajmaline, the findings of Siddiqui and Siddiqui in regard to the formation of a neutral, N-nitroso derivative of ajmaline on treatment of the base with nitrous acid in acetic acid medium, and of a tertiary methyl base through the methiodide, have been repeatedly checked up and confirmed. It has, however, been noted that, as reported by Robinson et al., treatment of ajmaline in hydrochloric acid medium gives a C-nitroso basic product. The resolution of this point of disagreement, however, had in effect already emerged from a subsequent communication of Robinson et al. (loc. cit.) which formulated the tautomeric carbinol-amine and imine-aldehyde structure for ajmaline. In this context, the authors had concluded from their studies that ajmaline in neutral or acid soluti on contains $=N.\overset{|}{C}H(OH)$ 'the abnormal carbinol-amine group', but that in alkaline solution only a small proportion of the form $=NH\ \overset{|}{C}HO$ (aldehyde-imine) is probably present in equilibrium with the carbinol-amine. The fact that the N-nitroso derivative of ajmaline is smoothly obtained in nearly theoretical yield in acetic acid medium controverts such a conclusion.

Siddiqui and Siddiqui had concluded a mono- and a di-acid character for ajmaline and isoajmaline, respectively. This conclusion proved erroneous, because isoajmaline hydrochloride had been prepared by them in ethereal medium, and ajmaline hydrochloride by reacting the base with aqueous hydrochloric acid, in which the weakly basic nitrogen in both the bases fails to form a salt.

With regard to neoajmaline which Robinson et al. have considered to be probably anhydrous ajmaline, it would appear from the present study that the two bases are quite distinct isomers. In the course of isolation of the alkaloidal complexes and individual bases from the fresh roots of *Rauwolfia*, it was observed that with identical procedure of isolation some batches of the drug yielded only neoajmaline while others gave the normal isomer,

ajmaline, depending on the age of the roots harvested from the same experimental farm. Moreover, neoajmaline was repeatedly obtained by slowly adding a warm aqueous solution of the hydrochloride to a strong, well-cooled solution of ammonia, and crystallising the precipitated base from dilute methanol. These conditions would not favour the formation of an anhydride, the more so because as reported by Siddiqui and Siddiqui the water of crystallisation tenaciously adheres to the ajmaline molecule, being completely eliminated only on heating *in vacuo* over a long period at 150°C. It has, however, been observed that the reduction of neoajmaline and ajmaline with borohydride results in the production of identical dihydroajmaline. The isomerism may, therefore, be due to the spatial arrangement of the H and OH of the carbinol amine group.

Taking into account the behaviour of ajmaline and its derivatives in respect of their cardiac action and the abnormal character of the carbinol-amine grouping in ajmaline, it was considered of great interest to study the stability of the carbinol-amine ring of the base, and the possible bearing of this factor on its cardiac action.

With this object in view, the von Braun reaction of cyanogen bromide[15] was carried out with ajmaline and hexahydroajmaline, after protecting the reactive hydroxyl groups and stabilising the carbinol-amine structure through acetylation. Under the conditions described in the experimental, a monocyano-monoacetyl derivative was readily obtained on treatment of diacetylajmaline with cyanogen bromide, while the same reaction takes about 24 hours for completion with hexahydrodiacetylajmaline. The comparative speed with which this reaction proceeds is a measure of the instability of the carbinol amine ring in ajmaline, and its considerable stabilisation through the reduction of the benzene ring, offering a co-relation of the stability of this ring with the intensity of cardiac action which, as referred to above, is 1000 times lower for hexahydroajmaline compared with that of ajmaline. It will be of interest to make a reference in this connection to the close relationship established by von Braun and his collaborators between the N-stability of the radicals attached to the basic nitrogen in the codeine series[16] and their action on respiration, and also to allied studies in the conessine series.[17,18] The cyanogen bromide reaction appears to proceed with the two bases on the pattern shown in Chart 1.

With the rupture of the carbinol amine ring in the case of both the diacetyl bases, the acetyl group attached to the ring is apparently eliminated as CH_3COBr, with the formation of a monoacetyl-

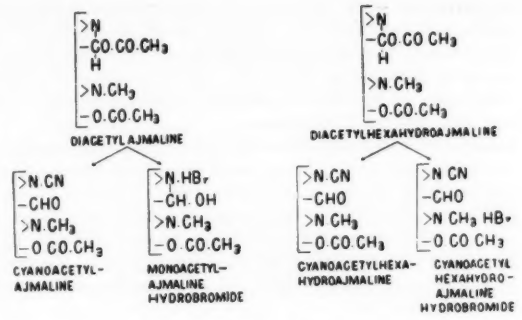


Chart 1

cyano derivative containing a free aldehyde grouping. As to the formation of the hydrobromides, it may be pointed out that a secondary elimination of HBr from the bromo alkyls resulting from the action of BrCN on tertiary amines has been noted by von Braun, and was also encountered with this reaction in the conessine series (loc. cit.). The formation of the monoacetylajmaline hydrobromide would indicate the comparative instability of the acetyl group attached to the carbinol amine ring and it is apparently hydrolysed off under the experimental conditions of this reaction, in which no special care was taken to completely free the reactants from moisture. It is also of interest to note that the reduction of the benzene ring in ajmaline brings about considerable increase in the basic strength of the indole nitrogen, with the result that a stable cyanohexahydroajmaline hydrobromide salt was found in the BrCN reaction with the base. It may be further stated that the use of chloroform employed by von Braun as a medium for the cyanogen bromide reaction (loc. cit.) proved altogether inadequate in the case of the ajmaline base, and that it proceeded smoothly in ethereal solution, as had also been observed with this reaction in the conessine series.

Further work on problems arising out of the present study is in progress with particular refernce to the synthesis of simpler compounds with a carbinol-amine grouping on the general model of the ajmaline molecule.

Experimental

Reduction of Ajmaline and Neoajmaline with Borohydride.—Ajmaline (1 g.) was dissolved in ethyl alcohol, freshly distilled over lime (10 ml.) and an aqueous solution of borohydride (0.5 g. in 10 ml.) was added to it, when the reaction mixture became slightly turbid. More ethyl alcohol was then added drop by drop and shaken

until a clear solution was obtained, and the reaction mixture was allowed to stand overnight at room temperature (25°C.). Any excess of borohydride was decomposed by cautious addition of dilute acetic acid. The solvent was removed on water bath, and the residue rubbed with ammonia and crushed ice. The crystalline precipitate thus obtained was filtered and washed with cold dilute ammonia (yield 0.9 g., m.p. 200-201°C.). Crystallised from methanol (rhombic plates) it melted at 203-205°C. Robinson et al. carried out the reduction in boiling aqueous methanol with potassium borohydride and obtained dihydroajmaline prisms, m.p. 200°C. Neoajmaline treated with borohydride in the same manner gave an identical dihydro product.

Reduction of Isoajmaline with Borohydride.—Isoajmaline was also treated with borohydride as in the case of ajmaline. The dihydro base finally obtained (yield 90%) crystallised from dilute methanol in rectangular plates which melted at 190-92°C. Robinson et al. recorded 188°C. as the melting point of dihydroisoajmaline.

Attempted Isomerisation of Dihydroajmaline.—Dihydroajmaline (0.25 g.) was refluxed in methanolic caustic potash (25 ml., 2% solution w/v) for 5 hours. The solvent was removed on the water bath and the thick viscous residue rubbed with crushed ice. The crystalline product thus obtained was filtered and washed free of alkali with ice-cold water. On re-crystallisation from methanol it melted at 203-205°C. (undepressed on admixture with dihydroajmaline).

On further refluxing for 12 hours with stronger methanolic caustic potash solution also (25 ml., 4% w/v), dihydroajmaline was recovered unchanged.

Borohydride Reduction of Hexahydroajmaline.—Hexahydroajmaline (0.2 g.) was dissolved in warm ethyl alcohol (freshly distilled over lime) and was treated with sodium borohydride (0.2 g.) in the manner already described. The product obtained on basification with ammonia became crystalline on standing. It was filtered, washed and crystallised with dilute methanol (prismatic rods), darkened at 210°C. onwards, shrank at 225°C. and melted at 228-30°C.

Catalytic Hydrogenation of Dihydroajmaline.—Dihydroajmaline (0.25 g.) was taken up in 50% acetic acid (20 ml.) and hydrogenated in the presence of Adams catalyst (0.025 g.). The reduction was complete in one hour. After filtering off the catalyst, the filtrate was concentrated to half the volume *in vacuo*. The precipitate obtained on the addition of ammonia crystallised from dilute methanol in prismatic rods which melted at 230°C. and showed no depression in m.p. on admixture with the product obtained by the borohydride reduction of hexahydroajmaline.

Bromination of Ajmaline.—Ajmaline (0.3 g.) in dry chloroform (4 ml.) was titrated with bromine solution in dry chloroform (1.5% w/v) with ice cooling. Absorption was very rapid and the reaction mixture gave test for free bromine when 11.5 ml. of the bromine solution had been added (4.9 ml. = 1 Br.). The solvent was removed *in vacuo* at room temperature. The micro-crystalline residue obtained on complete removal of the solvent darkened at 210°C. onwards and frothed up at 298-300°C. with decomposition (295°C. recorded by Robinson as the m.p. (decomp.) for anhydrous bromoajmaline). On crystallisation from ethyl alcohol it showed m.p. 235-39°C. with shrinking at 225°C. Siddiqui and Siddiqui recorded 230°C. as the melting point (decomp.) of the bromo derivative. After drying *in vacuo* over P_2O_5 at 100°C., this melting point remained unaffected.

In another experiment ajmaline (0.5 g.) dissolved in chloroform (8 ml.) was treated with bromine in chloroform (1.58 % w/v), drop by drop with ice cooling. After about one atom of bromine had been added, slight turbidity started appearing on further addition which vanished on stirring. When 13.3 ml. had been added (equivalent 1.7 Br) the addition of a further drop of bromine solution gave a persistent turbidity with a tendency to partial crystallisation. Bromine addition was stopped at this stage and the solvent removed *in vacuo*. The white semi-crystalline residue was freed from any unreacted ajmaline by repeated extraction with ethyl acetate and repeatedly crystallised from methanol when it formed stout prismatic hexagonal plates melting at 278-82°C. as against 235-39°C. recorded for the bromo derivative crystallised from methanol in the preceding experiment. The product was fairly soluble in water from which it crystallised in cauliflower-like aggregates of silky needles melting at 230°C. (decomp.), which on crystallisation from methanol reverted to the prismatic form and showed m.p. 268-70°C. (decomp.).

Monobromoajmaline.—Bromoajmaline, m.p. 239°C. (decomp.), dissolved in dry ethyl acetate, was saturated with dry ammonia gas. The precipitated ammonium bromide was filtered off and the solvent removed on the water bath. The solution of the residue in methanol gave on slow evaporation fine colourless needles which melted at 182°C. (decomp.). The melting point was identical with that of the product obtained after Robinson's

method on treatment of the bromination product with aqueous ammonia. (In the case of conessine, it was possible to obtain a dibromo base on treatment of the bromine addition product (dibromoconessine dihydrobromide) with dry ammonia in organic solvents).

Bromination of Isoajmaline.—Isoajmaline (0.206 g.) in dry chloroform was titrated with bromine solution in dry chloroform (1.58% w/v) with ice cooling. The reaction mixture showed the presence of free bromine (tested with starch-potassium iodide paper) when 0.13 g. had been added (0.11 g. = 1 mole). The solvent was removed under reduced pressure at room temperature (25 °C.). The residue crystallised on rubbing with methanol in triangular plates, m.p. 225-228 °C. (decomp.). (Robinson et. al. recorded 288-289 °C. (decomp.) as the melting point for 'anhydrous' bromoisoajmaline).

Action of Bromine on Dihydroajmaline.—A well-cooled solution of dihydroajmaline (0.24 g.) in dry chloroform was treated with bromine in dry chloroform (1.58% w/v). The absorption of bromine appeared to be very slow as judged by the disappearance of the yellow colour. One mole of bromine was however added and the mixture kept in the cold for about an hour. The solvent was then removed *in vacuo* at room temperature (25 °C.) and the residue which became powdery on rubbing with ether was filtered and washed well with ether. The amorphous powder decomposed with charring at 220-222 °C. It was sparingly soluble in water and the aqueous solution produced a precipitate with aqueous silver nitrate. The amorphous powder, which failed to crystallise from methanol or dilute methanol, was treated with ammonia in aqueous medium, and the liberated base crystallised from methanol, when it melted at 200-201 °C. showing no depression in melting point on admixture with dihydroajmaline.

Bromination of Methylajmaline.—Methylajmaline (0.33 g.) in dry chloroform was titrated with bromine in dry chloroform (1.38% w/v) with ice cooling. The reaction mixture showed the presence of free bromine when 16.5 ml. (ca. 3 Br) had been added. The supernatant liquid was decanted from the precipitate which formed with the addition of bromine. On rubbing with ether the yellowish sticky residue turned into a nearly colourless powder, which when washed well with ether darkened from 180 °C. onwards, and melted with decomp. at 290 °C. The bromo product was then treated in dry ethyl acetate suspension with dry ammonia gas, the resulting solution of the liberated base filtered off from ammonium bromide and the filtrate freed of the solvent *in vacuo*. The residue on complete removal of the solvent melted at 120 °C. but failed to crystallise. It was characterised as methylisoajmaline through its hydriodide, which on crystallisation from methanol melted at 198 °C. (decomp.). (Robinson et al. have recorded m.p. 195-96 °C.).

Reaction of Bromine on Hexahydroajmaline.—Hexahydroajmaline (0.3 g.) was dissolved in an excess of chloroform (about 30 ml.) in which it is difficultly soluble. The solution was well cooled in ice and titrated with bromine solution (1.38% w/v). Absorption was rapid and the reaction mixture gave the test for free bromine when 6 ml. of the solution had been added (about 1 Br).

The residue obtained on complete removal of the solvent *in vacuo* at ordinary temperature was found to be readily soluble in water and gave a precipitate with silver nitrate. The base liberated from the aqueous solution of the product with dilute alkali and crystallised from ethyl alcohol (square plates) showed m.p. 150 °C., as recorded for hexahydroajmaline by Robinson et al.

Action of Bromine on Diacetylhexahydroajmaline.—Diacetylhexahydroajmaline on treatment with bromine under conditions already described gave a water-soluble reaction product from which the base was recovered unchanged. It was characterised through its perchlorate m.p. 190-192 °C., undepressed on admixture with an authentic sample of the salt.

Action of Cyanogen Bromide on Diacetylajmaline.—Diacetylajmaline (5 g.) was dissolved in ether (50 ml.) with the help of a little ethyl acetate, and the solution concentrated to about 120 ml. To the solution was added drop by drop a solution of 1.5 g. cyanogen bromide (1.15 mole) in ether (15 ml.) with efficient ice cooling and stirring. The gelatinous precipitate, which separated out during the addition in the course of about 10 minutes, turned into a granular powder on rubbing. After keeping in the cold for about 3 hours the ethereal solution was filtered, repeatedly washed with small quantities of water, dried over sodium sulphate and allowed to concentrate by slow evaporation overnight. The product thus obtained (5.0 g.) crystallised from ethyl acetate in colourless, stout, prismatic rods and hexagonal plates which were soluble in hot ethyl acetate, very sparingly so in ether and alcohol, insoluble in water, melted at 205-207 °C. and analysed for monoacetylcyanoajmaline.

Calculated for $C_{23}H_{27}O_3N_3$: C, 70.23; H, 6.87; N, 10.88. Found on drying at 100 °C. *in vacuo*: C, 69.57; H, 6.96; N, 10.75.

The granular precipitate obtained in the reaction (0.8 g.) melted at 250-252 °C. and when repeatedly crystallised from a large quantity of ethyl acetate helped with a little ethyl alcohol finally gave colourless crystals which showed m.p. of 266 °C., were soluble in water, very sparingly so in ethyl acetate, almost insoluble in ether or petroleum ether and analysed for monoacetylajmaline hydrobromide.

Caculated for $C_{22}H_{28}O_3N_2.HBr$: C, 58.79; H, 6.68; N. 6.46; Br, 17.81. Found on drying at 100 °C. *in vacuo*: C, 58.61; H, 6.11; N. 6.10; Br, 17.99.

The equeous solution of the hydrobromide was basified with ammonia and the liberated base on recrystallisation from dilute alcohol melted at 212-214 °C. and analysed for monoacetylajmaline.

Calculated for $C_{22}H_{28}O_3N_2$: C, 71.73; H, 7.60; N, 7.60. Found on drying at 100 °C. *in vacuo*: C, 71.77; H, 7.87; N, 7.52.

In the process of working up the reaction mixture small quantities of crystalline products, probably resulting from side reactions and melting at 194-196 °C. and 220-224 °C., were also obtained but were not followed up.

Hydrolysis of Monoacetylcyanoajmaline—Isoajmaline.—Monoacetylcyanoajmaline (0.5 g.) was refluxed over water bath with methanolic potassium hydroxide (5% w/v, 10 ml.). The hydrolysis proceeded at a very slow rate with the formation of sodium carbonate and evolution of ammonia. After about 50 hours, the reaction mixture gave on keeping in the cold for 48 hours, a bulky crop of colourless crystals which was filtered off from the supernatant liquid, washed with a little ice-cold methyl alcohol and then with water (yield, 0.18 g.). On crystallisation from methyl alcohol it gave colourless stout rods which melted at 256 °C. and analysed for isoajmaline (m. p. 265 °C.). On further refluxing, the mother liquor from the reaction crystallisate gave, after about another 40 hours, 0.17 g. of the hydrolysed base (total yield, 0.35 g.).

Action of Cyanogen Bromide on Diacetylhexahydroajmaline. — Diacetylhexahydroajmaline (0.57 g.), obtained by treating the crystalline perchlorate of the base with ethereal ammonia in ether suspension, was dissolved in ether (3 ml.). To the ethereal solution of the base was added drop by drop, a solution of cyanogen bromide 0.2 g. (a little in excess of one mole) in dry ether (5 ml.) with efficient ice cooling and stirring. No immediate precipitation followed, as had happened in the case of this reaction with diacetylajmaline. The reaction mixture was then allowed to stand in the cold for about 24 hours, in the course of which a thick jelly-like mass separated out which was repeatedly triturated with ether. The combined ethereal extract was freed of the solvent on the water bath and the residue thus obtained was crystallised from methanol, out of which it came out in colourless needles which were readily soluble in ethyl alcohol and ethyl acetate, sparingly soluble in ether, less so in petroleum ether, melted at 146-148 °C. and analysed for monoacetylcyanohexahydroajmaline.

Calculated for $C_{23}H_{33}O_3N_3$: C, 69.17; H, 8.27; N, 10.52. Found on drying at 100 °C. *in vacuo*: C, 69.39; H, 8.40; N, 10.39.

The ether insoluble, gelatinous residue was completely freed of the solvent, taken up in water and extracted with small quantities of ethyl acetate. The colourless residue left on removal of the solvent from the aqueous layer on the water bath, crystallised from a mixture of absolute alcohol and ethyl acetate in colourless needles (m.p. 256-257 °C.) which were freely soluble in water and alcohol, almost insoluble in ethyl acetate and ether, and analysed for monoacetylcyanohexahydroajmaline hydrobromide.

Calculated for $C_{23}H_{33}O_3N_3.HBr.H_2O$: C, 55.42; H, 7.22; N, 8.42; Br, 16.06. Found on drying at 100 °C. *in vucuo*: C, 55.82; H, 7.03; N, 8.31; Br, 16.21.

The free base obtained from the hydrobromide salt on liberation with ammonia crystallised from methanol in colourless needles which melted at 146-148 °C. and showed no depression in the melting point on admixture with the cyano derivative obtained directly from the ether soluble portion of the reaction product.

The total yield of the cyano base was nearly theoretical, and derived in about equal proportions from the ether soluble and the ether insoluble fractions of the cyanogen bromide reaction product.

Acetylation of Ajmaline and Hexahydroajmaline.—*Diacetylajmaline and Diacetylhexahydroajmaline.*—In the preparation of diacetylajmaline needed for the BrCN reaction, considerable difficulty was experienced in following the method employed by Robinson et al. (refluxing with acetic anhydride in benzene solution for 12 hours). Apart from being time consuming and complicated in its working it was noted that slight impurities in the reactants or the solvent very adversely affected the yield, and a simpler method

was, therefore, worked out for the acetylation of these bases which consisted in heating the components directly for 5 minutes in the water bath, removing acetic anhydride completely *in vocuo* and crystallising the product when diacetylajmaline (hexagonal prismatic rods, m.p. 192-194°C.) and diacetylhexahydroajmaline (isolated as perchlorate needles, m.p. 190-192°C.) were obtained in about 70% yield.

Summary

The action of bromine on ajmaline and its various derivatives has been studied in detail to elucidate the mechanism of this reaction, and earlier points of disagreement in respect of the chemical characteristics of ajmaline have been experimentally checked up for clarification. Further, on the basis of studies in the action of cyanogen bromide on the diacetyl derivatives of ajmaline and hexahydroajmaline, the antifibrillant cardiac action of ajma'ine has been co-related with the N-stability of the carbinol-amine structure, which appears to function as a 'cardiophore' grouping in the ajmaline molecule.

Acknowledgement

The auothors wish to acknowledge with thanks the kind courtesy of Messrs Boehringers of Mannheim in supplying ajmaline needed for this work. Their thanks are also due to Mr. Sardar Ali Khan for his assistance in the preparative work and to Dr. M. Ikhlas Khan for testing the various ajmaline derivatives for their cardiac action.

References

1. Siddiqui and Siddiqui, J. Indian Chem. Soc., **9**, 539 (1932).
2. Siddiqui and Siddiqui, J. Indian Chem. Soc., **12**, 37 (1935).
3. van Itallie and Steenhauer, Arch. Pharm., **270**, 313 (1932).
4. Mukherjee, Robinson and Schlittler, Experientia, **5**, 215 (1949).
5. Anet, Chakravarti, Robinson and Schlittler, J. Chem. Soc., 1242 (1954).
6. Robinson, Chem. & Ind. (London), 285 (1955).
7. Finch, Hobson and Robinson, Chem. & Ind. (London), (1955).
8. Woodward, Quart. Revs., **10**, 138 (1956).
9. Siddiqui, J. Indian Chem. Soc., **16**, 421 (1939).
10. Siddiqui, Pakistan J. Sci. Ind. Research, **1**, 3 (1958).
11. Deininger, Pakistan J. Sci. Ind. Research, **1**, 6 (1958).
12. Deininger, Pakistan J. Sci. Ind. Research, **2**, 114(1959).
13. M. Ikhlas Khan, private communication.
14. Vasisht and Siddiqui, J. Sci. Ind. Research (India), **4**, 440 (1946).
15. von Braun and Schwarz, Chem. Ber., **35**, 1279 (1902).
16. von Braun, Kuhn and Siddiqui, Chem. Ber., **59**, 1081 (1926).
17. Siddiqui and Siddiqui, J. Indian Chem. Soc., **11**, 787 (1934).
18. Siddiqui, Siddiqui and Sharma, Proc. Indian Acad. Sci., **4A**, 283 (1936).

PHARMACOLOGICAL INVESTIGATION OF SERPAJMALINE, AN ALKALOIDAL FACTOR OF RAUWOLFIA SERPENTINA

R. DEININGER*

Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

Recently S. Siddiqui[1] reported the discovery of a pharmacologically active *Rauwolfia* alkaloidal fraction which was named 'serpajmaline'. This fraction includes the alkaloids serpentine, serpentinine and ajmaline, two unknown substances and a carbohydrate-like substance, and possesses remarkable blood pressure reducing properties without any sedative action, as recently described by us.[2] It has long been known that the *Rauwolfia Serpentina* alkaloids, reserpine[3] and rescinnamine,[4] have a greater blood pressure reducing action than the other alkaloids but it has not hitherto been possible to answer the question whether the hypotensive action is primarily inherent or whether it depends only on its central depressive action. It thus seems noteworthy that serpajmaline, which contains no reserpine, has a strong blood pressure reducing action without central side effects. In the present work we have therefore extended our previous results on the blood pressure reducing action of serpajmaline and have investigated more closely various peripheral effects of this fraction.

Methods

Blood Pressure Experiments on Dogs.—Using a *bloodless method*, we prepared the art. carotid externally looped in a skin sheath, following Wezler and Thauer.[5] The blood pressure was measured as by Riva Rocci on the non-anaesthetised animal.

For the *sanguinous method* we used a Hg manometer for recording the arterial pressure from the carotid. To prevent coagulation we injected 500 I.U./kg. Vetren with a preliminary 500 I.U. in the supply tube. Heart frequency was recorded with the ordinate recorder developed by Heuwing. Narcosis; Pentothal 15 mg./kg. and phenobarbitone 25 mg./kg. intravenous, phenobarbitone 75 mg./kg. intraperitoneal. Injections in the V. Femoralis.

Blood Pressure Experiments on Cats.—Recording of the arterial pressure from the carotid with a Hg manometer. As regards preventing coagulation see dogs. Injection in the Femoralis. Narcosis: Chloralose 80 mg./kg. intraperitoneal. Injections in the V. Femoralis.

Intestine and Spleen in situ.—With cats under the above Chloralose narcosis or with spinal cats, a bubble sonde was introduced into the jejunum through the oesophagus and the stomach, and this was connected to a water manometer. The recording of the spleen volume was made pethysmographically and connected to a piston recorder.

Isolated organs.—Terminal ileum of guinea-pigs was used in the usual arrangement following Magnus.

Temperature Monitoring.—For recording the body temperature of rabbits we used Hartmann and Braun's apparatus.

Preparation.—The serpajmaline was isolated by Dr. S. Siddiqui in the Chemical Research Division of the Central Laboratories.

Experiments

(1) Action of Serpajmaline on the Circulation.—Serpajmaline has a blood pressure reducing action on dogs and cats, dogs being more sensitive than cats. The magnitude of the blood pressure reduction depends on the condition of the experimental animal, the depth of narcosis, and the dosage.

(a) Effect on the Blood Pressure of Anaesthetised Dogs

Small doses of serpajmaline, 0.25-1 mg./kg., injected intravenously, produce a transient fall of blood pressure of a few mm. Hg. After 2 mg./kg., however, the blood pressure was reduced by 40 mm. Hg for about 20 min. on the average. Figure 1 shows the effect on the blood pressure of repeated injections of serpajmaline at intervals of 10 min. From this figure it can be seen that serpajmaline is still capable of depressing the blood pressure even after it has been greatly reduced by repeated injections.

Reserpine has no effect after rapeated injections. After a reduction of the blood pressure has been produced once, reserpine is incapable of depressing the blood pressure even once more. The bradycardiac action of serpajmaline can be

*Present address: Topferstr. 21, Utersen/Holstein, Germany,

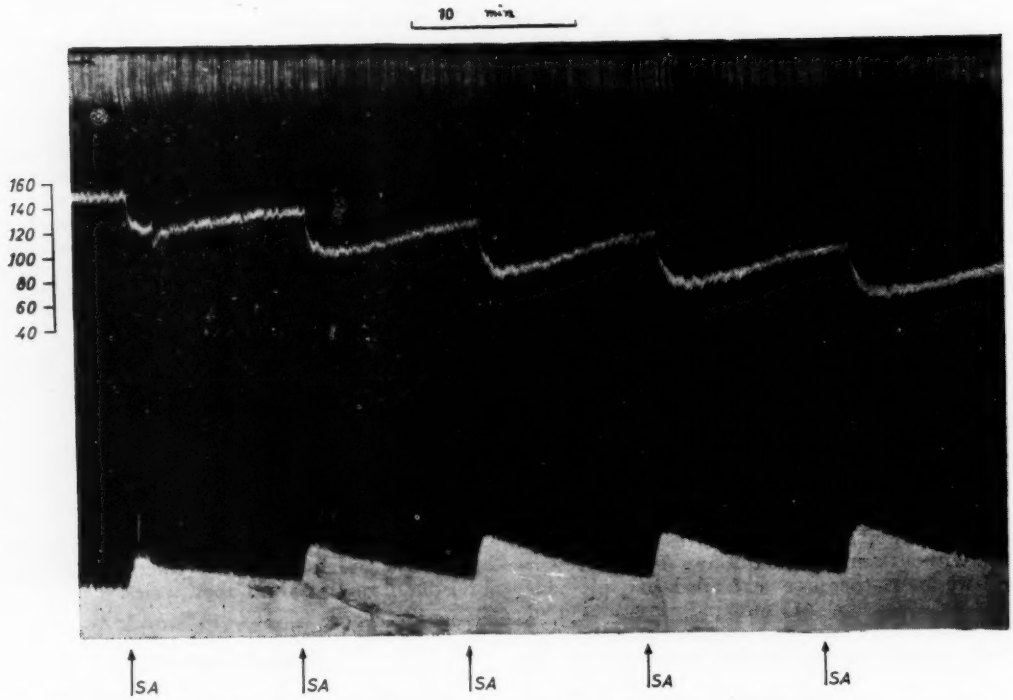


Fig. 1.—The effect on the blood pressure and heart frequency after repeated injections of serpajmaline. Dog 25 kg., Pentothal-phenobarbitone anaesthesia. Recording of blood pressure with Hg manometer from the carotid. Above: respiration; middle: blood pressure; and below: heart frequency. Time in minutes. After repeated injections of serpajmaline, 2 mg./kg. i.v., at ten-minute intervals, the blood pressure falls in steps. The bradycardia increases.

seen clearly from Fig. 1; this action is also cumulative.

At this dosage (2 mg./kg.) reserpine has no acute blood pressure reducing action. A transient blood pressure reduction of short duration is obtained in the control test (0.5% acid acetic) (see Fig. 2). The hypotensive action of reserpine does not show until 1-2 hours after the injection, and the magnitude of the reduction is 20-40 mm. Hg. Because of these circumstances, a quantitative comparison is very difficult, if not impossible. It may however be stated that, in comparison with reserpine, serpajmaline has a much stronger acute depressive action on the blood pressure (see Fig. 2).

(*b*) *Effect on the Conscious Dog with Carotid in External Skin Sheath*

In the experiments on the conscious dog with carotid in external skin sheath there was general concordance with the results on anaesthetised animals. The effect of serpajmaline was stronger

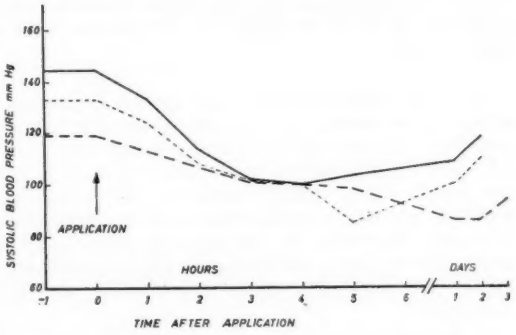


Fig. 3.—The effect of single applications of serpajmaline or reserpine on systolic blood pressure in conscious dogs. Dogs with carotid in external skin sheath.

————: Serpajmaline 5 mg./kg. intramuscularly. Average values of 3 dogs.

.....: Serpajmaline 5 mg./kg. orally. Average values of 6 dogs.

- - - - - - -: Reserpine 1 mg./kg. intramuscularly. Avreage values of 3 dogs.

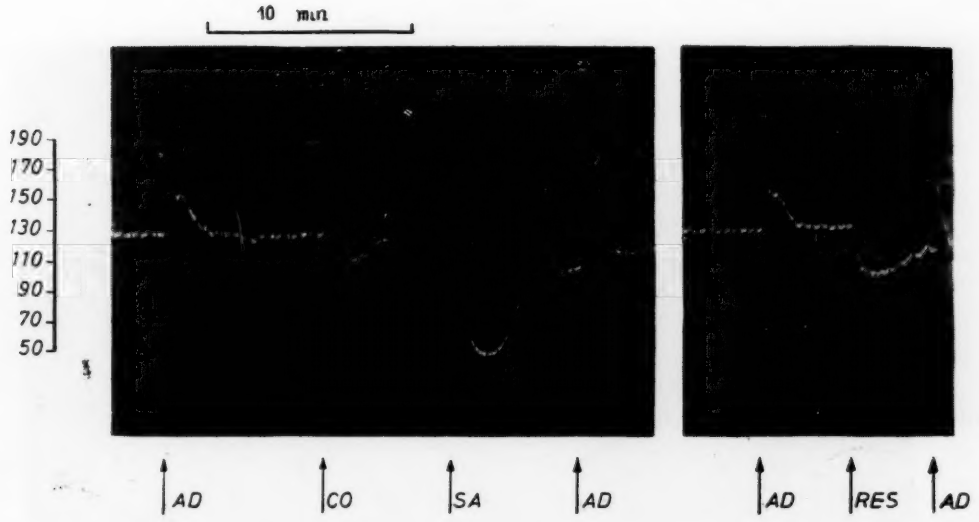


Fig. 2.—Comparison of the acute blood pressure effect of serpajmaline and reserpine. Dog 15 kg., pentothal-phenobarbitone anaesthesia. Recording of blood pressure with Hg manometer from the carotid. Above: respiration; below: blood pressure. Time in minutes. The acute fall of blood pressure after 1 mg./kg. reserpine (RES) corresponds to the control (CO) whereas serpajmaline (SA) 1 mg./kg. depresses the blood pressure clearly and reduces the effect of adrenalin (AD) 12γ.

and more enduring on conscious animals than on anaesthetised ones. In all cases, 5 mg./kg., was given orally and intramuscularly. This dose resulted in a reduction of 40-60 mm. Hg in the blood pressure. After oral application of 5 mg./kg., serpajmaline also has a definite long-term action, up to 24 hours. During the period of hypotension there was no miosis, no relaxation of the nictitating membrane, and no diarrhoea or sedative action. In comparison with serpajmaline, the effect of reserpine, 1 mg./kg. intramuscular, can be seen in Fig. 3. Orthostatic callapse did not occur after serpajmaline when the dog jumped from the table, and a rise in blood pressure could still be obtained when the dog was given exercise (Fig. 4).

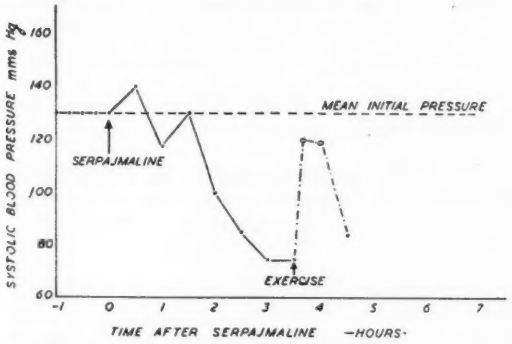


Fig. 4.—The effect of exercise on the hypotension produced in a conscious dog by a single oral dose of serpajmaline. (Dose 5 mg./kg.). Dog 20 kg., with carotid in external skin sheath.

(c) Effect of Serpajmaline on the Blood Pressure and Spleen Volume of Anaesthetised and Decapitated Cats

The effect of serpajmaline on the blood pressure of anaesthetised cats is weaker than on dogs. Five mg./kg. serpajmaline injected intravenously into the anaesthetised cat had little effect on blood pressure. On the spinal cat there is sometimes a short-term rise of blood pressure. Rothlin[6] has described a rise of blood pressure with various ergot alkaloids. However, notwithstanding the rise in blood pressure, there is an increase in the spleen volume of the spinal cat (Fig. 5).

(2) Adrenergically Inhibiting Effects of Serpajmaline.—In anaesthetised and decapitated cats, serpajmaline inhibits the pressor action of adrenalin and noradrenalin. Similarly, the contraction of the nictitating membrane after adrenalin is inhibited (Figs. 5,6). On the other hand, the contraction of the nictitating membrane after pre-ganglionic stimulation is inhibited to only a small degree (Fig. 6). The block which is to be seen in Fig. 6 after peripheral vagus stimulation is discussed elsewhere. The contraction of the spleen volume after adrenalin is inhibited by serpajmaline (Fig. 5).

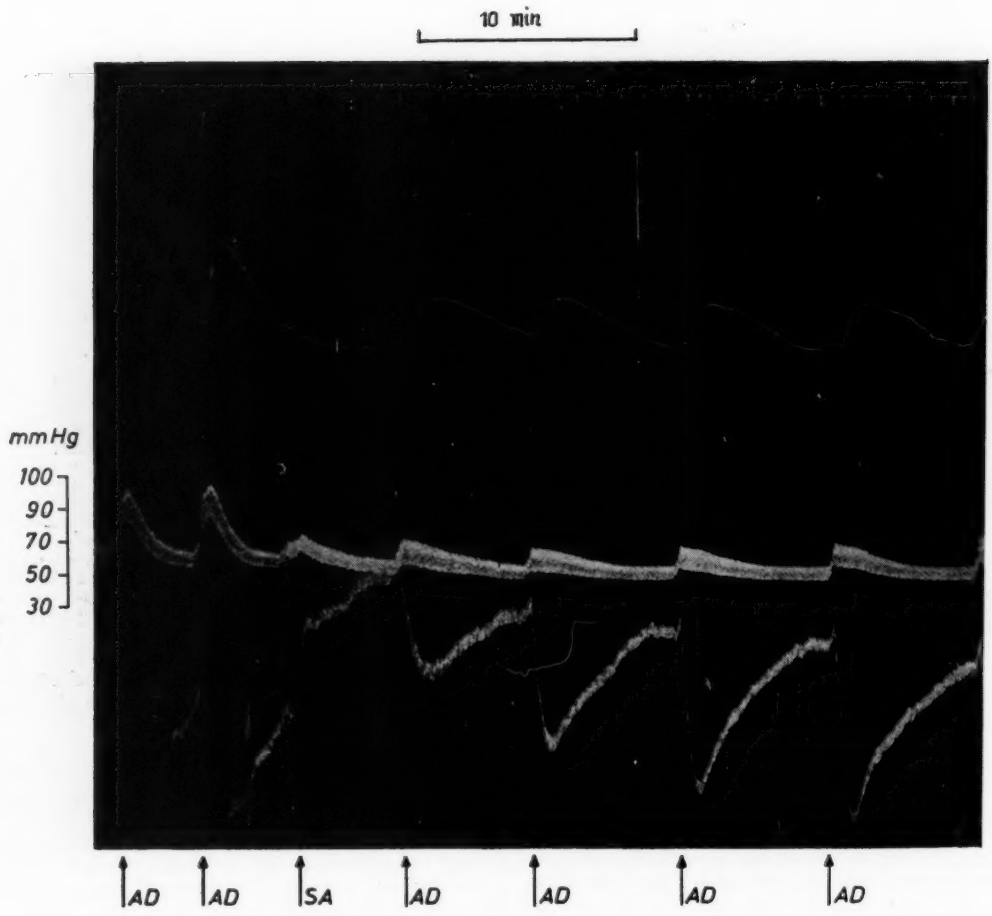


Fig. 5.—Inhibition of the increase of blood pressure caused by adrenalin, contractions of membrana nictitans and of spleen valume. Spinal cat, 2.2 kg., artificial respiration. Recording of blood pressure with Hg manometer from the carotid. Intravenous injections of adrenalin (AD) 10γ after serpajmaline 10 mg./kg. i.v. (SA). Above: membrana nictitans; middle:blood pressure; and below: spleen volume. Time in minutes. Transient rise of blood pressure and increase of spleen volume after serpajmaline. The adrenalin effects are inhibited.

The tachycardiac effect of adrenalin and noradrenalin on anaesthetised dogs is definitely reduced, the inhibiting effect for noradrenalin being greater than for adrenalin, as can be seen from Table 1.

TABLE 1

Frequency rise after	Adrenalin 30%	Nor-adrenalin 26%
After serpajmaline 2 mg./kg. i.v.	19%	9·5%

The inhibitory action of adrenalin on the intestine is slightly weakened (Fig. 7).

(3) **Effect of Serpajmaline on Body Temperature.**—No variation of the body temperature of rabbits was observed after subcutaneous injection of 1-5 mg. /kg. serpajmaline.

(4) **Action of Serpajmaline on the Intestine.**—It has long been known that some *Rauwolfia* alkaloids have an exciting effect on the stomach intestinal tract.[7] With serpajmaline also, after injection of 10 mg./kg. i.v. in cats there is an increase of motility and tone in the intestine

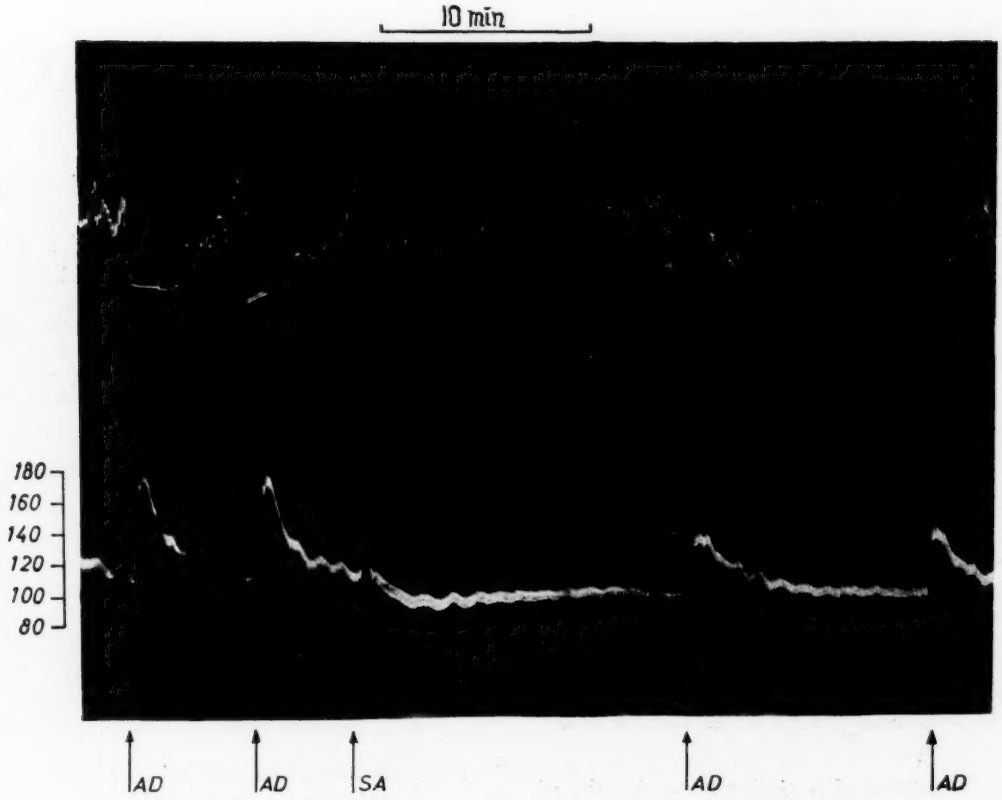


Fig. 7.—Influence of serpajmaline on the contractions of the jejunum in situ. Cat 13 kg. Chloralose anaesthesia. Recording of blood pressure with Hg manometer from the carotid. Above: volume of jejunum; and below: blood pressure. Time in minutes. After serpajmaline 10 mg./kg. (SA) the pressor effect of adrenalin (AD) on the blood pressure is reduced. The inhibitory effect of adrenalin on the intestine is slightly reduced. The intestine reacts with enhanced tone and contractions.

in situ. On the isolated ileum of guinea-pigs serpajmaline in concentrations of 1×10^{-5} inhibits contractions induced by barium chloride and acetylcholin.

Discussion

The hypotensive action of serpajmaline is not complicated by any of the side effects encountered with compounds such as reserpine or rescinnamine, the ganglion blockers or the anti-adrenalin drugs. Thus there is no sedative action, anorexia or diarrhoea or postural hypotension. Serpajmaline induces a bradycardia of the sinus. On the basis of the anti-adrenergic activity it is to be assumed that the inhibition of the adrenergic innervation of the vessels is the cause of the effect on the circulation. However, this inhibition is certainly not necessarily or exclusively the sole cause. The action of the serpajmaline on the relieving reaction of the carotid sinus[2] provides evidence that not only the periphery of the vessels but also central mechanisms of the circulation are affected by the action. But it is difficult to draw conclusions as to central activity of a drug known to possess anti-adrenalin activity. Spinal animals show a transient rise of blood pressure after serpajmaline. Dihydro ergot alkaloids raise the blood pressure in spinal animals and lead to reductions of blood pressure only when there is an intact connection between medulla and the upper thoracic marrow,[8] which points to medullary centres being involved. The fact that serpajmaline is a mixture of five bases

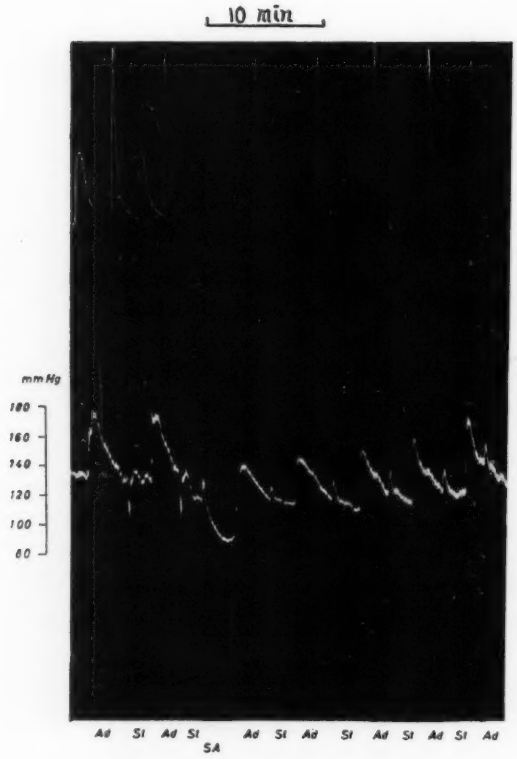


Fig. 6.—Influence of serpajmaline (*a*) on the effect of adrenalin on the membrana nictitans and the blood pressure, (*b*) on the contractions of the nictitans and the blood pressure after supramaximal stimulation of the vagus-sympathicus. Cat 2.3 kg. Chloralose anaesthesia. Recording of blood pressure with Hg manometer from the carotid. Above: membrana nictitans; and below: blood pressure. Intravenous injections of adrenalin (AD) 10γ, stimulation of the vago-sympathicus (ST). After serpajmaline 8 mg./kg., lowering of the blood pressure and inhibition of the contractions of the membrana nictitans and pressor effect produced by adrenalin. Blockage of the peripheral vagus effect. No effect on the nictitans membrane after preganglionary stimulation.

and carbohydrates renders more difficult the pharmacological interpretation of the complex mechanism producing the action. Further experiments for elucidating the pharmacology and toxicology of serpajamaline will be treated in greater detail in a separate paper.

Summary

Serpajmaline (5 mg./kg.) reduces the systolic blood pressure of conscious dogs for at least 24 hours. The drug is effective by both the oral and the intramuscular routes.

In anaesthetised animals, serpajmaline reduces blood pressure and has a bradycardiac action. The nictitating contraction, the pressor, and the tachycardiac actions of adrenalin and noradrenalin are inhibited. In spinal animals, transient rises of blood pressure are observed, together with an increase of spleen volume. Serpajmaline increases motility and tone of the intestine in situ. In vitro, serpajmaline inhibits the action of barium chloride and acetylcholine on the intestine.

Acknowledgement

The author is grateful to Dr. Bilquees Jamal Mir and Dr. Sarfaraz Siddiqui for assisting in some of the experiments.

References

1. S. Siddiqui, Pakistan J. Sci. Ind. Research, **1**, 1 (1958); Chem. & Ind. (London), 1270 (1957).
2. R. Deininger, Pakistan J. Sci. Ind. Research, **1**, 6 (1958).
3. J. M. Muller, E. Schlittler and H.J. Bein, Experientia, **8**, 338 (1952).
4. G. Cronheim, W. Brown, J. Cawthorne, M. I. Toekes and J. Ingari, Proc. Soc. Expt. Biol. Med., **86**, 120 (1954).
5. K.Wezler and R. Thauer, Z. exper. Med., **108**, 377 (1940).
6. E. Rothlin, C. r. Soc. Biol. (Paris), **119**, 1302 (1935); Helv. Physiol. Acta, **2**, C48 (1944); Schweiz. med. Wochschr., 1254 (1946).
7. R. N. Chopra, J. C. Gupta and B. Mukherjee, Indian J. Med. Research, **21**, 261 (1933).
8. H. Konzett and E. Rothlin, Brit. J. Pharmacol., **8**, 201 (1953).

THE PHARMACOLOGY AND TOXICOLOGY OF SERPAJMALINE

K. J. Child, B. Davis, Helen M. Sharpe and E.G. Tomich
Glaxo Laboratories Limited, Greenford, Middlesex, England

and

R. Deininger*
Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

Serpajmaline is a pale brown powder, readily soluble in water, obtained from the fresh roots of *Rauwolfia serpentina*;[1,2] it contains the alkaloids serpentine, serpentinine and ajmaline, as well as two unidentified substances and some carbohydrate-like material. Serpajmaline contains neither reserpine nor rescinnamine.

Deininger[3] claimed that serpajmaline was a more potent hypotensive drug than reserpine and, further, that it did not have the latter's central sedative effects.

Deininger[4] later investigated the action of serpajmaline on anaesthetised cats and on conscious and anaesthetised dogs and studied its effects on the ileum, both isolated and in situ.

In this paper we record the results of further pharmacological and toxicological experiments on serpajmaline.

Methods

Studies in Conscious Animals

1. *Acute Toxicity*

Mice.—The acute toxicity of serpajmaline was determined by the intravenous, intraperitoneal and oral routes on female fawn mice (GFF strain), and by the oral route in female albino mice (A2G strain). The mice weighed between 16 and 22 g. Serpajmaline solutions were freshly prepared in distilled water immediately before use, and each dose was administered to a group of not less than five mice. Percentage mortalities were assessed seven days after administration, and the LD 50 values were determined by the method of de Beer.[5]

Rats.—The acute toxicity of serpajmaline was determined by the intravenous, intraperitoneal and oral routes on male rats (WAG strain, 100 to 150 g.).

The drug was administered to groups of five rats, and the percentage mortalities were assessed seven days later.

* Present address: Toepferstr. 21, Utersen/Holstein, Germany.

2. *Subacute Toxicity*

The subacute toxicity of serpajmaline was investigated in albino mice (A2G strain).

Groups of five male and five female mice received daily oral doses of serpajmaline for twelve weeks. The dose was 125 mg./kg., which is approximately one-fifth the oral LD 50 value for this strain. Each mouse was weighed daily; the oxygen consumption rate of each group was measured daily during the third week of treatment only. Two control groups, each of five mice, were included in this test. After twelve weeks' treatment the group oxygen consumption were measured on two consecutive days and the mice were then paired for breeding. They were not dosed with serpajmaline during the breeding period.

3. *Effect on Barbiturate Activity in Mice*

One hundred and fifty male mice (GFF strain, 16 to 26 g.) were injected intraperitoneally with serpajmaline (50 mg./kg. one-fifth LD 50). At intervals ranging from one hour to seven days after receiving serpajmaline, the mice were injected intraperitoneally with hexobarbitone (100 mg./kg.,5 mice per group) or intravenously with barbitone (275 mg./kg., 10 mice per group). The sleep-times of the mice receiving hexobarbitone were measured in a cabinet thermostaticaliy controlled at 37 °C.; the induction periods of the barbitone-injected mice were measured at room temperature.

Control groups, receiving barbiturates only, were included with each experiment to allow for day-to-day variations in barbiturate response.

4. *Analgesic Activity in Mice*

Serpajmaline was tested for analgesic activity in mice by the method of Woolfe and Macdonald.[6] Two groups of ten male mice (GFF strain, 17 to 22 g.) were injected intraperitoneally with serpajmaline (10 or 100 mg./kg.). At intervals after the injection, ranging between 10 minutes and 3 hours, the mice were placed individually on a hot plate maintained at 55 °C. and their reaction times were recorded. The reaction time is defined as the intervals between placing the mouse on the

hot plate and observing signs that indicate the onset of pain, e.g., kicking, paw retraction.

5. Effect on the Blood Pressure of Renal Hypertensive Rats

The rats used in these experiments were made hypertensive by a modification of the renal clamping technique first described by Goldblatt.[7] Young rats of both sexes (40 to 100 g.) were anaesthetised with ether, and a small silver clamp was placed on one renal artery. This reduced but did not completely prevent the flow of blood to the kidney. On recovering from the anaesthetic the rats were maintained in an environment at 28° C. and given free access to a commercial rat cube diet[8] and tap water. Two to three months later a stable chronic renal hypertension was apparent in about 70% of the rats; those that did not become hypertensive (i.e. their blood pressure values were < 140 mm. Hg.) were rejected.

The blood pressures of the hypertensive rats were determined at regular intervals by the tail plethysmographic method of Byrom and Wilson.[9] Blood pressures were assessed under light ether anaesthesia; because of this the determinations were made at intervals of not less than three hours.

Five groups of ten renal hypertensive rats were used in this experiment. One group served as controls, and the other four groups were injected intraperitoneally with serpajmaline on four consecutive days. Group 2 received individual doses of 6.25 mg./kg., and groups 3, 4 and 5, 12.5, 25 50 mg./kg., respectively. Blood pressure recordings were made one hour after each injection and 24 hours and 4 days after the fourth dose.

6. Brain Serotonin-Releasing Activity

Nine adult rabbits were used in this experiment. Three served as controls, three received serpajmaline (10 mg./kg.) and three reserpine (1 mg./kg.). All injections were made into the marginal ear veins. Twenty-four hours later the rabbits were killed and their brains were removed, weighed and assayed spectrofluorometrically for total serotonin, by the method of Bogdanski et al.[10]

7. Effect on Blood Sugar Concentration

Three adult rabbits were injected intravenously with serpajmaline (10 mg./kg.); blood samples were taken before, and 5, 15, 30 and 60 minutes after the injection. Blood sugar levels were estimated by the method of Hagedorn and Jensen.

8. Effect on Clotting Time

Three adult rabbits were injected intravenously with serpajmaline (10 mg./kg.). The rabbits were bled before injection and at intervals thereafter, the samples being collected in waxed stoppered tubes. Clotting times were determined to the nearest half-minute, by inverting the tubes once every 30 seconds.

9. Neuromuscular Blocking Activity in Chicks

Serpajmaline was tested for neuromuscular-blocking activity in conscious chicks by the method of Buttle and Zaimis.[11] All injections were given intravenously.

10. Reserpine-like Action in Kittens

One male and one female kitten (900 to 1000 g.) received single oral doses of serpajmaline (50 mg./kg.). The powder was administered in gelatine capsules. The kittens were observed for 6 hours for evidence of parasympathomimetic activity typical of reserpine.

11. Tranquillising Effect in Monkeys

Two female cynomolgus monkeys (3 to 4 kg.) were given serpajmaline, one animal receiving 5 mg./kg., intravenously and the other 50 mg./kg. orally. Two other monkeys in the same weight range received reserpine (1 mg./kg.), either intravenously or orally.

STUDIES ON ANAESTHETISED ANIMALS

1. Cats

Cats weighing between 2 and 5 kg. were anaesthetised with chloralose (80 mg./kg. intraperitoneal route); blood pressure, respiration and E.C.G. were recorded. The vagus and cervical sympathetic nerves were separated and the responses of the cardiovascular system to peripheral vagal stimulation and of the nictitating membrane to peripheral sympathetic stimulation were recorded. A cannula was inserted into the saphenous vein and injections of saline, adrenaline, noradrenaline, acetylcholine and histamine were administered intravenously.

In two experiments serpajmaline was administered into the lateral cerebral ventricle via a Feldberg cannula,[12] and in another experiment the effects of serpajmaline on the motility of the small intestine in situ were recorded by the method of Straub.

Serpajmaline was administered by intravenous injection, intravenous infusion, intraventricular injection, intraduodenal injection and via an oesophageal catheter directly into the stomach. In several experiments serpajmaline was also injected through a catheter passing down the external jugular vein with its tip terminating at the point where the great veins enter the right auricle.

2. Dogs

Mongrel bitches weighing between 8 and 12 kg. were anaesthetised intravenously or intraperitoneally with chloralose (100 mg./kg.). When necessary anaesthesia was maintained with small doses of sodium pentobarbitone.

The blood pressure, respiration and E.C.G. were recorded, and the drugs were injected either through a cannula in the femoral vein or directly into the duodenum. The responses of the cardiovascular system to peripheral vagal stimulation and of the nictitating membrane to pre-ganglionic stimulation were recorded.

3. Monkeys

Serpajmaline and reserpine were compared in six female cynomolgus monkeys weighing between 3 and 4 kg. The animals were anaesthetised with sodium pentobarbitone (30 mg./kg. intravenously), and the blood pressure, respiration and E.C.G. were recorded. All injections were given through a cannular inserted in the femoral vein.

4. Rabbits

Rabbits were anaesthetised with urethane (1 g./kg.) injected intraperitoneally, and the blood pressure and respiration were recorded. All drugs were injected into the femoral vein.

STUDIES ON ISOLATED TISSUES

In vitro effects of serpajmaline were studied on guinea-pig ileum, rabbit duodenum, non-oestrus rat uterus, chick semispinalis cervicis muscle, perfused rabbit heart and beating rabbit auricles.

1. Guinea-pig Ileum

The ileum was suspended in a 20 ml. bath of oxygenated Tyrode solution at 31°C. Longitudinal contractions were recorded with a frontal writing lever on a smoked drum.

2. Rabbit Duodenum

The duodenum was removed from a freshly killed rabbit and suspended in oxygenated Tyrode solution at 35°C.

3. Rat Uterus

One horn of the uterus of a non-oestrus rat was suspended in a bath of de Jalon solution at a temperature of 31°C. The solution was oxygenated with 95% oxygen and 5% carbon dioxide.

4. Chick Semispinalis Muscle

One of the semispinalis cervicis muscles of the chick was removed under ether anaesthesia and suspended in a bath of oxygenated Tyrode solution at 40.5°C. Longitudinal contracture of the muscle was recorded with a frontal writing lever.

5. Perfused Beating Rabbit Heart

Rabbit hearts were perfused by a modification of the Langendorff technique. The hearts were perfused with McEwen solution[13] at 37°C. and at a perfusion pressure of 40 cms. of water. The perfusion fluid when fully saturated with a mixture of 95% oxygen and 5% carbon dioxide had a pH of 7.4. Coronary flow was recorded with an inflow recorder, and the amplitude was recorded on a smoked drum. Drugs were added to the perfusion fluid via a polythene cannula opening near the coronary arteries so that dilution was reduced to a minimum.

6. Perfused Fibrillating Rabbit Heart

Fibrillation was induced in perfused beating rabbit hearts by electrically stimulating the ventricle and reducing the concentration of potassium in the McEwen solution to three-quarters of the normal amount. After fibrillating for 15 minutes a perfused heart never spontaneously reverted to normal rhythm; further, an injection of sodium chloride, potassium chloride or distilled water from pH 5 to pH 8 did not affect the fibrillation.

7. Rabbit Auricles

The effect of drugs on the maximum drive rate of the rabbit auricles was determined by the method of Dawes[14] as modified by Alles and Ellis.[15]

The heart was removed from a freshly killed rabbit and the auricles were dissected free from other heart muscle and suspended in a bath of oxygenated (95% oxygen and 5% carbon dioxide) Locke solution at a temperature of 29°C. The auricles were stimulated electrically with square wave pulses of 3 m.secs width and an intensity of

Table 1.—The Acute Toxicities of Serpajmaline in Mice and Rats.

Species	Strain	Sex	LD 50 value — mg./kg.		
			Intravenous	Intraperitoneal	Oral
Mouse	GFF	Female	29	240	760
Mouse	A2G	Female	Not tested	Not tested	660
Rat	WAG	Male	52	230	> 1100

Table 2.—The Effects of Serpajmaline on Weight Increase in Mice (A2G).

Group	Number in group	Group mean body weight (g.)													Per cent increase in body weight
		Weeks of treatment													
		Initial	1	2	3	4	5	6	7	8	9	10	11	12	
Test—Males ..	4*	8.5	13.1	17.4	20.1	20.4	22.0	23.3	24.5	24.3	26.5	27.8	26.6	27.3	222†
Control—Males ..	5	8.6	14.2	18.5	21.7	23.7	24.4	25.8	26.2	27.0	27.9	28.9	29.2	30.4	253
Test—Females ..	5	9.3	12.9	15.7	17.4	18.3	18.4	19.1	20.3	20.6	21.6	22.5	22.1	22.7	144†
Control—Females	5	9.1	13.8	16.9	18.9	19.6	19.4	20.9	21.2	21.8	22.5	23.4	23.3	24.0	164

* One animal died at the beginning of the experiment through faulty administration technique.

† The depressions in growth rate are significant $0.1 > P > 0.05$).

Table 3.—The Group Oxygen Consumption Rates of Mice after Daily Oral Dosing with Serpajmaline.

Group	Number in group	Group oxygen consumption rate litres/kg./hour						
		Days of treatment						
		15	16	17	20	21	85	86
Test—Males	4*	4.02	3·71	3·71	3.13	3.97	3.88	3.59
Control—Males	5	4.83	4.81	4.02	3.51	3.87	3.97	3.86
Test—Females	5	4.77	4.36	3.52	3.00	4.11	4.11	3.72
Control—Females	5	4.50	3.67	3–34	3.55	3.73	3.29	3.13

* See Table 2.

4 to 6 volts., (twice the threshold value determined at a stimulation rate of 180 per minute).

The normal heart rate and the maximum drive rate were determined immediately before and immediately after the auricles had been in contact with the drug for 20 minutes.

Results

STUDIES IN CONSCIOUS ANIMALS

1. *Acute Toxicity*

The results are given in Table 1.

In order to know whether the acute toxicity of serpajmaline changed on standing, the acute intravenous toxicity of a 0.3% w/v solution of serpajmaline was determined on female mice (GFF strain, 16 to 20 g.) immediately after preparation and after standing at room temperature (ca. 20°C.) for 3, 6, 24 and 168 hours.

There were no changes in the intravenous LD 50 during the seven days of the experiment, the values ranging from 27 to 29 mg./kg.

2. *Subacute Toxicity*

The group mean bodyweights obtained during the twelve weeks of treatment are given in Table 2 and the group oxygen consumption rates during the third week and at the end of treatment are shown in Table 3.

The group oxygen consumption rates of mice during and after treatment with serpajmaline do not differ from those of the untreated controls. Twelve weeks treatment with the serpajmaline slightly depressed ($0.1 > p > 0.05$) the growth rate in both the males and the females, but in no way affected fertility in males or females (Table 4).

3. *Effect on Barbiturate Activity in Mice*

The results together with those previously obtained in a similar experiment with reserpine are given in Table 5. It will be seen that serpajmaline had no effects on the activities of the two barbiturates in mice.

4. *Analgesic Activity in Mice*

The group mean reaction times after serp-

TABLE 5.—THE EFFECTS OF INTRAPERITONEAL INJECTIONS OF SERPAJMALINE OR RESERPINE ON BARBITURATE ACTIVITY IN MICE.

Time after injection	Serpajmaline (50 mg./kg.)				Reserpine (2 mg./kg.)			
	Hexobarbitone sleep time Mean ± S. D.* (mins.)		Barbitone induction-time Mean ± S. D.† (mins.)		Hexobarbitone sleep time Mean ± S. D.* (mins.)		Barbitone induction-time Mean ± S. D.† (mins.)	
	Test	Control	Test	Control	Test	Control	Test	Control
1 hour	21 ± 4	23 ± 3	16.9 ± 1.1	19.2 ± 2.6	33.4 ± 10.9	26.0 ± 5.6	8.0 ± 1.3	19.5 ± 2.9
2 hours	Not tested	..	Not tested	..	69.8 ± 28.8	26.0 ± 5.6	4.9 ± 0.7	19.5 ± 2.9
3 „	26 ± 4	23 ± 3	17.1 ± 2.3	19.2 ± 2.6	92.4 ± 21.0	23.2 ± 1.9	3.2 ± 0.9	19.5 ± 2.9
6 „	21 ± 2	23 ± 3	17.3 ± 1.3	19.2 ± 2.6	75.8 ± 11.7	22.3 ± 1.9	3.8 ± 1.3	20.0 ± 2.9
1 day	24 ± 4	25 ± 5	20.2 ± 1.5	19.2 ± 2.6	30.4 ± 6.6	24.8 ± 5.2	12.9 ± 5.0	19.2 ± 1.7
2 days	24 ± 5	25 ± 5	23.0 ± 2.4	24.4 ± 2.1	15.0 ± 3.4	16.6 ± 4.0	20.3 ± 2.1	18.3 ± 2.1
3 „	16 ± 3	25 ± 5	21.3 ± 1.4	22.5 ± 1.5	12.3 ± 3.3	22.3 ± 1.8	34.5 ± 3.6	17.7 ± 1.5
4 „	28 ± 5	25 ± 3	22.8 ± 2.6	20.5 ± 2.5	11.4 ± 2.7	24.8 ± 5.2	31.3 ± 8.4	18.1 ± 3.8
5 „	24 ± 2	25 ± 3	22.4 ± 1.3	21.7 ± 2.2	12.0 ± 3.2	16.6 ± 4.0	22.6 ± 2.6	18.3 ± 2.8
6 „	19 ± 5	25 ± 3	19.7 ± 1.2	20.5 ± 2.5	17.6 ± 6.1	23.0 ± 2.9	20.2 ± 2.3	19.0 ± 1.4
7 „	Not tested	..	21.3 ± 1.4	21.7 ± 2.2	22.2 ± 2.5	27.0 ± 7.0	19.0 ± 3.5	18.0 ± 3.8

* 5 mice per group. † 10 mice per group.

ajmaline together with the control times are given in Table 6.

It will be seen that serpajmaline had no analgesic action even at a dose level equivalent to almost half the LD 50 value. Results obtained in a similar experiment with pethidine hydrochloride are included for comparison.

5. Effect of Repeated Doses of Serpajmaline on Blood Pressure in Renal Hypertensive Rats

The results are illustrated in Fig. 1. There were no changes in response over the four days when doses between 6.25 and 25 mg./kg. were used. There may have been slight cumulation, however, at a dose level of 50 mg./kg.

6. Brain Serotonin-Releasing Activity

Shore, Pletscher, Tomich, Carlsson, Kuntzman and Brodie[16] have shown that reserpine injected intravenously into rabbits rapidly reduces the level of serotonin in the brain. The low level of brain serotonin persists for about 40 hours and is finally restored to its normal value after 5 or 6 days. In the rauwolfia group of alkaloids only the tranqu-

TABLE 4.—RESULTS OF BREEDING EXPERIMENTS.

Group	Number of pairs	Number of pairs having litters	Number of young born	Number of young reared
Test	5*	5*	27	21†
Control	5	5	26	21†

* One of the males served two females as only 4 test males were available.
† One whole litter killed at birth.

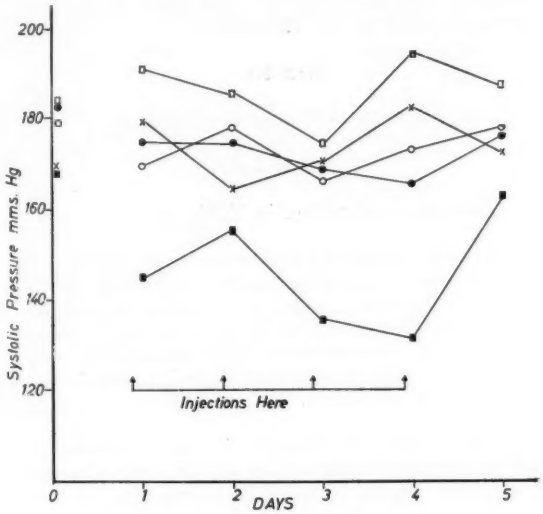


Fig. 1.—The effect of serpajmaline on systolic blood pressure in renal hypertensive rats. Intraperitoneal injections were given on four successive days and the blood pressure recorded one hour after each injection.

- ● Control animals.
- □ 6.25 mg./kg. serpajmaline.
- × 12.5 „ „
- ○ 25 „ „
- ■ 50 „ „

TABLE 6.—TESTS FOR ANALGESIC ACTIVITY USING SERPAJMALINE AND PETHIDINE IN MICE (ALL INJECTIONS GIVEN INTRAPERITONEALLY).

Drug	Dose mg./kg.	Mean reaction time ± S. D.* (seconds)					
		Minutes after injecting drug					
		Initial	10	30	60	120	180
Serpajmaline ..	10	6 ± 2	7 ± 3	8 ± 3	7 ± 2	7 ± 2	7 ± 2
Serpajmaline ..	100	6 ± 2	11 ± 3	9 ± 3	10 ± 3	11 ± 3	10 ± 2
Pethidine	50	8 ± 2	43 ±17	28 ±15	17 ±10	Not tested	Not tested

* 10 mice per group.

illising members are able to release brain serotonin, and Brodie and his colleagues have suggested that these two activities may be associated. Hence it seemed of interest to ascertain the effect of serpajmaline on brain serotonin.

The results are given in Table 7. All results have been corrected for percentage recovery, known amounts of serotonin being added to normal rabbit brain, which was assayed simultaneously. These recoveries varied from 48 to 70%.

TABLE 7.—THE EFFECTS OF SERPAJMALINE AND RESERPINE ONE DAY AFTER ADMINISTRATION ON BRAIN-SEROTONIN LEVELS IN RABBITS (BOTH DRUGS INJECTED INTRAVENOUSLY).

Brain serotonin concentration (μg./g.)		
Controls	Serpajmaline (10 mg./kg.)	Reserpine (1 mg./kg.)
0.53	0.70	0.09
0.52	0.56	0.11
0.58	0.60	0.10
Average: 0.53	0.62	0.10

The normal serotonin concentration in rabbit brain is 0.52 to 0.58 μg./g. fresh tissue. Twenty-four hours after reserpine (1 mg./kg.) the level fell to 0.09 - 0.11 μg./g., but serpajmaline (10 mg./kg.) had no effect.

7. Effect on Blood Sugar Concentration

An intravenous injection of reserpine (5 mg./kg.) into the rabbit increased the blood sugar level within one hour of administration.[17] Serpajmaline had no effect on blood sugar when injected intravenously at 10 mg./kg.

8. Effect on Blood Clotting Time

Serpajmaline did not influence clotting time in the rabbit.

9. Neuromuscular-Blocking Activity in Chicks.

Intravenous injections into the chick of neuromuscular-blocking drugs produce characteristic patterns of muscular paralysis, which differ with the type of drug employed.[11] Thus "depolarising blockers" (e.g. decamethonium) produce a period of spasticity in the hind limbs and retraction of the head, whereas "competitive blockers" (e.g. *d*-tubocurarine) produce flaccid paralysis only. Both syndromes become apparent immediately after injection. Blocking agents of the third type, the anticholinesterases, produce a "depolarising block" resulting from the accumulation of of acetylcholine. The pattern of spasticity is similar to that observed with decamethonium, but there is a delay before onset, its length depending on the dose administered.

Intravenous injections of serpajmaline in doses from 2 to 4 mg./kg. were without effect. Higher doses (5 to 10 mg./kg.) produced slight ataxia, which was enhanced by covering the chick's eyes. Serpajmaline administered as a single intravenous dose of 15 mg./kg. was lethal to chicks.

Doses of decamethonium, *d*-tubocurarine and neostigmine required to produce characteristic neuromuscular block in the chick are 50, 500 and 1000 μg./kg. respectively.

Serpajmaline does not show neuromuscular-blocking or anticholinesterase activity in the chick.

10. Reserpine-like Activity in Kittens

Serpajmaline (50 mg./kg. orally) had no apparent effect on conscious kittens. There were no signs of gastric discomfort, diarrhoea, anorexia, sedation or relaxation of the nictitating membrane. Such responses are readily obtained with reserpine in doses as low as 0.5 mg./kg.

11. Tranquillising Effect in Monkeys

Within one hour of receiving reserpine, both monkeys became docile, approached the front of the cage and were obviously sedated. This condition was still apparent three hours later, but by 24 hours both had resumed their characteristically hostile attitude. Diarrhoea occurred in the monkey receiving reserpine by the intravenous route, but not in the one treated orally.

The two monkeys treated with serpajmaline remained hostile throughout the experiment. There were no signs of sedation or obvious discomfort in either animal. The serpajmaline did not appear to cause pain when injected into the femoral vein.

STUDIES IN ANAESTHETISED ANIMALS

1. Cats

Intravenous Injection.—Small doses of serpajmaline (0.25 to 2.0 mg./kg.) had no effect on

blood pressure, respiration, E.C.G. or the cardiovascular responses to adrenaline, noradrenaline, acetylcholine or histamine. The response of the nictitating membrane to pre-ganglionic stimulation remained unimpaired, but the fall in blood pressure and the bradycardia produced by peripheral vagal stimulation were completely abolished by serpajmaline in doses greater than 1 mg./kg. However, the apnoea resulting from central vagal stimulation remained unaffected. The vagal-blocking action of serpajmaline was reversible when doses of 1 or 2 mg./kg., were given, the response returning to normal within two hours.

The smallest dose of serpajmaline (0.25 mg./kg.) increased the tone and motility of the gut for about two minutes, and these effects increased in severity but not in duration with increasing dose.

With larger doses of serpajmaline (5 to 10 mg./kg.) a fall in blood pressure was produced; its degree and duration depended on the initial blood pressure level. In general, a fall of between 40 and 60 mms. Hg was obtained, the pressure returning to normal within 20 minutes. The fall in blood pressure was associated with depression of respiration, slight bradycardia, increase in the P-R interval of the E.C.G., reduction in the pressor response to noradrenaline and reversal of the pressor response to adrenaline. In addition, the reflex bradycardia normally obtained at the height of the noradrenaline response was abolished. The response of the nictitating membrane to adrenaline was reduced, and that to supra-maximal pre-ganglionic stimulation was sometimes reduced and sometimes unaffected (Fig.2). Peripheral vagal stimulation was blocked, but the apnoea resulting from central vagal stimulation remained unaltered. The blocking action of these doses on the effects of peripheral vagal stimulation was irreversible during the experimental period of four to five hours. The vascular responses to acetylcholine and histamine remained unchanged by serpajmaline in doses of 10 mg./kg.

Doses greater than 10 mg./kg. produced acute respiratory depression and death, when the heart remained in diastole.

Intravenous Infusion.—Most of the effects described above could be obtained by intravenously infusing serpajmaline at a rate of 0.5 mg./kg./minute. A complete block of the responses to peripheral vagal stimulation was obtained long before any effects on blood pressure became apparent (Fig.3). At this rate of infusion the responses of the nictitating membrane to preganglionic stimulation and to injected adrenaline were reduced by about 50 per cent. The blood pressure fell by about 40 mm.

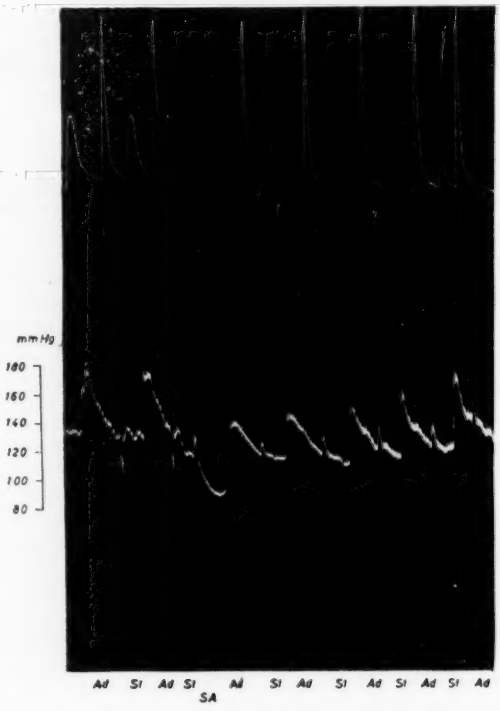


Fig. 2.—The effect of serpajmaline on the blood pressure and nictitating membrane of the anaesthetised cat (2.3 kg., chloralose 80 mg./kg. intraperitoneally). Intravenous injections of 10 µg. adrenaline at "Ad" and supramaximal stimulation of the vagosympathicus at "St". Serpajmaline, 8 mg./kg., injected intravenously at "SA".

Hg, bradycardia was observed, and the pressor response to noradrenaline was reduced and that to adrenaline was reversed. The depressor response to injected acetylcholine was not altered.

On stopping the infusion, the blood pressure rapidly returned to normal. A second infusion conducted at the same rate in the same animal produced a second fall in blood pressure, which was still obtained after cutting both vagi.

Respiration was not depressed with this rate of infusion, but with more rapid infusion rates some respiratory depression was observed. In a cat maintained under artificial respiration a total dose of serpajmaline of 100 mg./kg. infused at a rate of 1 mg./kg./minute was not fatal.

Injection Close to the Heart.—The fall in blood pressure and the bradycardia produced by peripheral vagal stimulation were completely blocked by

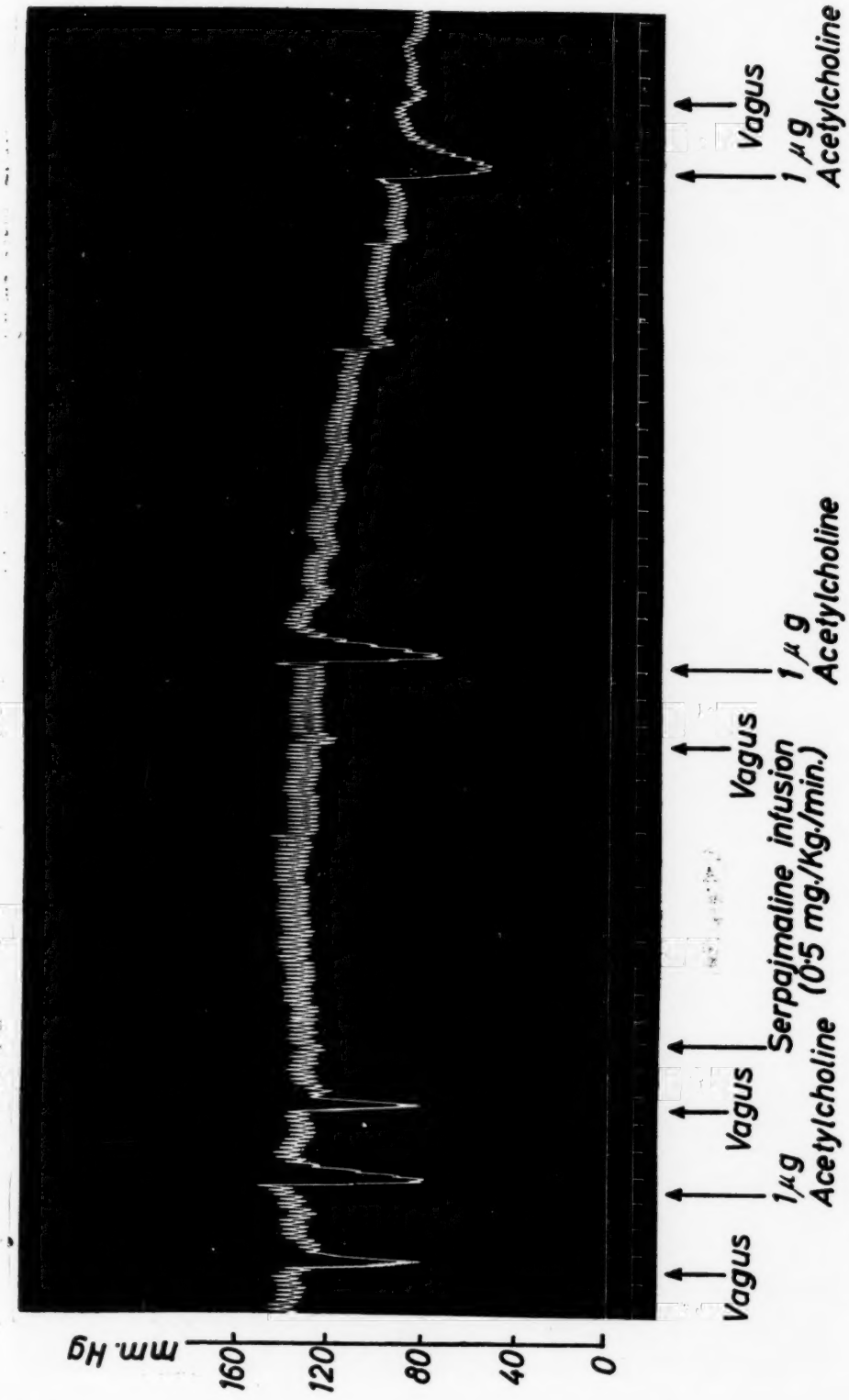


Fig. 3.—Effect of intravenous infusion of serpajmaline on the blood pressure of the anaesthetised cat (3.0 kg., chloralose 80 mg./kg. intraperitoneally). Vagus stimulated with supramaximal stimuli at "V" and acetylcholine 1 µg. injected intravenously at "Ach". Serpajmaline infusion started at "SA" (0.5 mg./kg./minute).

injecting 50 μg. of serpajmaline close to the point where the great veins enter the right auricle.

Injection into the Lateral Cerebral Ventricle.—Doses from 50 to 400 μg. administered directly into the lateral cerebral ventricle had no pharmacological actions in anaesthetised cats. Under these conditions reserpine (25 to 50 μg.) depressed both respiration and blood pressure.

Injection Directly into the Duodenum or Administration via Oesophageal Catheter into the Stomach.—Administration of serpajmaline into either the stomach or the duodenum of anaesthetised cats produce a fall in blood pressure after a latent period of 15 to 30 minutes. The fall in pressure, although small (20 to 40 mms. Hg) was attributed to the drug and not to deterioration in the animal's condition, the fall being associated with a blockage of peripheral vagal stimulation and a reduction in the pressor responses to adrenaline and noradrenaline. The drug did not depress respiration or alter the responses of the nictitating membrane to adrenaline or to supra-maximal pre-ganglionic stimulation. In one or two experiments the blood pressure returned to the pre-injection level, but usually it was still depressed at the end of the experiment.

Serpajmaline was not very active by the oral or intraduodenal routes, a dose 50 to 100 mg./kg. being required to produce pharmacological effects.

In two cats 100 mg./kg. administered into the stomach produced a rise in blood pressure. In the remaining six cats so treated this dose of serpajmaline was hypotensive.

2. *Dogs*

Intravenous Injection.—Doses of serpajmaline less than 5 mg./kg. did not lower the blood pressure of the anaesthetised dog. A complete block of peripheral vagal stimulation was obtained with 2 mg./kg.

Doses between 5 and 10 mg./kg. produced falls in blood pressure between 50 and 70 mms. Hg and lasting for 30 minutes. The fall in pressure was associated with reduced pressor responses to noradrenaline, reversed adrenaline responses and a depression of respiration. The fall in blood pressure produced by acetylcholine was unchanged.

Serpajmaline in doses of 20 mg./kg. produced a long lasting fall (100 mms.Hg) in blood pressure. The respiration was completely depressed, but normal respiration was again apparent after a short period of artificial respiration (2 to 5 minutes). The blood pressure remained depressed throughout the experiment.

Intraduodenal Injection.—Serpajmaline in doses less than 10 mg./kg. had no effect when administered intraduodenally into anaesthetised dogs. Doses of 10 or 20 mg./kg. produced falls in blood pressure (about 30 mms. Hg) after a latent period of 15 minutes. The depressor effect lasted from one to two hours.

3. *Monkeys*

Doses of serpajmaline less than 2 mg./kg. were without effect, but 2 or 4 mg./kg. produced a small fall in blood pressure and bradycardia, and blocked the effects of peripheral vagal stimulation. Higher doses (5 to 10 mg./kg.) produced a fall in pressure of approximately 50 mms. Hg, which lasted for 30 minutes. The pressor response to noradrenaline was reduced; that to adrenaline was blocked but not reversed.

Fifty mg./kg. given in divided doses (5, 10, 15 and 20 mg./kg.) at five minute intervals produced a sustained fall in blood pressure lasting for more than two hours, partial recovery occurring during the third hour. In this monkey the fall in pressure was associated with slight respiratory depression.

In similar experiments a single dose of reserpine of 5 mg./kg. produced a sustained fall in blood pressure (70 to 80 mms. Hg) lasting throughout the experimental period of 3 to 4 hours. Respiration in all three monkeys injected with reserpine was depressed, but no reductions in the pressor responses to adrenaline and noradrenaline were observed, and the effects of peripheral vagal stimulation were not blocked.

4. *Rabbits*

Serpajmaline has a smaller depressor activity in rabbits than in other species. Five mg./kg. produced only a transient fall in blood pressure; a dose of 10 mg./kg. was lethal.

Twenty mg./kg. administered in four doses of 5 mg./kg. at five minute intervals produced a fall in blood pressure of 50 mms. Hg.

STUDIES ON ISOLATED TISSUES

Guinea-pig Ileum.—At concentrations less than 10^{-5} serpajmaline had no effect on guinea-pig ileum, neither did it antagonise the actions of barium chloride or acetylcholine. At higher concentrations (1.3 to 1.6×10^{-5}) it increased the spontaneous activity of the ileum, but depressed contractions induced by barium chloride or acetylcholine. However, increased sensitivities to both barium chloride and acetylcholine were apparent after

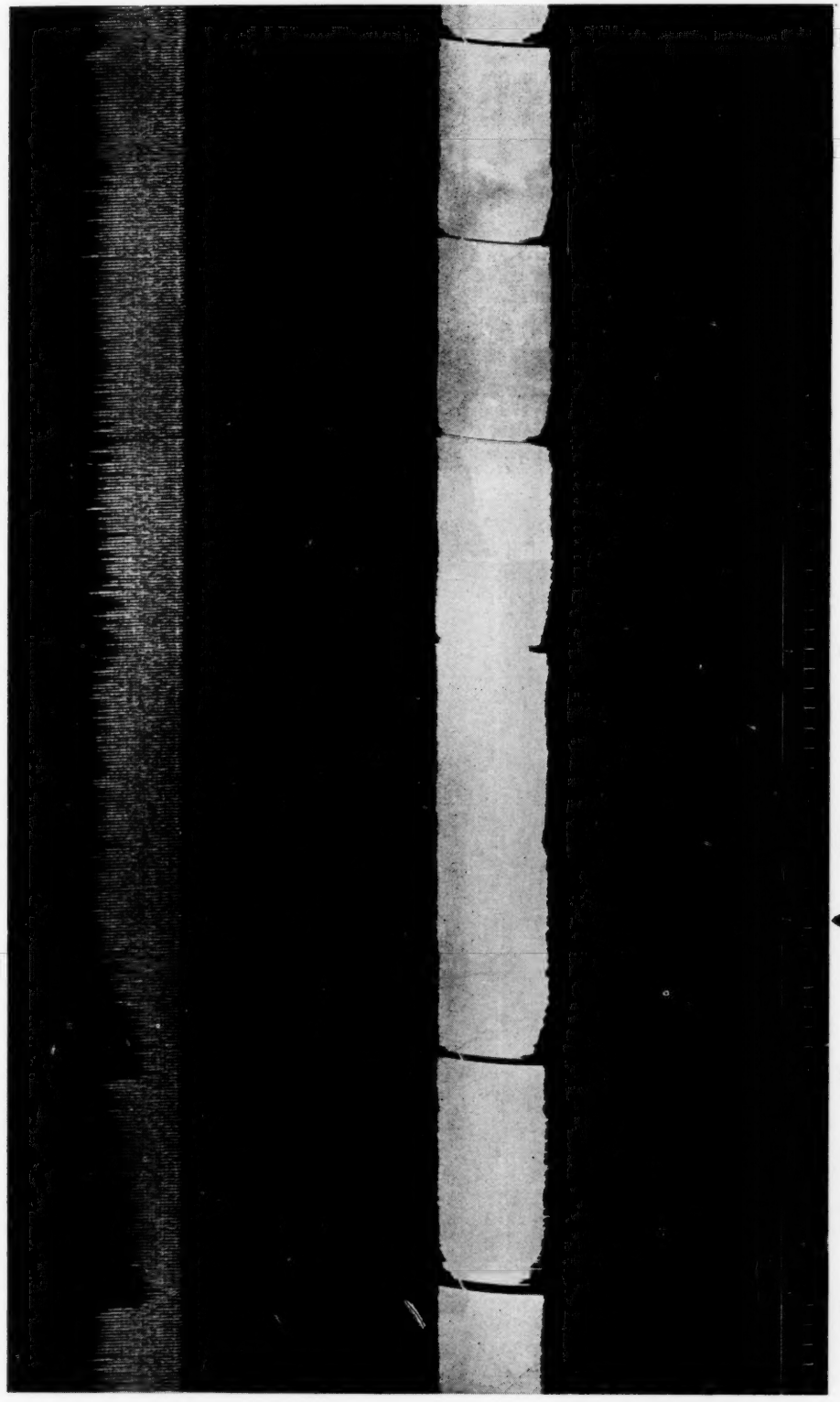


Fig. 4 :—Effect of serpajmaline on the response of the isolated perfused rabbit heart to acetylcholine. Upper tracing: coronory inflow. A decrease in coronory inflow is recorded as a decreased height of tracing. Lower tracing: Amplitude of beat. At 10 µg. of acetylcholine injected into perfusion fluid. At SA 200 µg. serpajmaline injected into perfusion fluid.

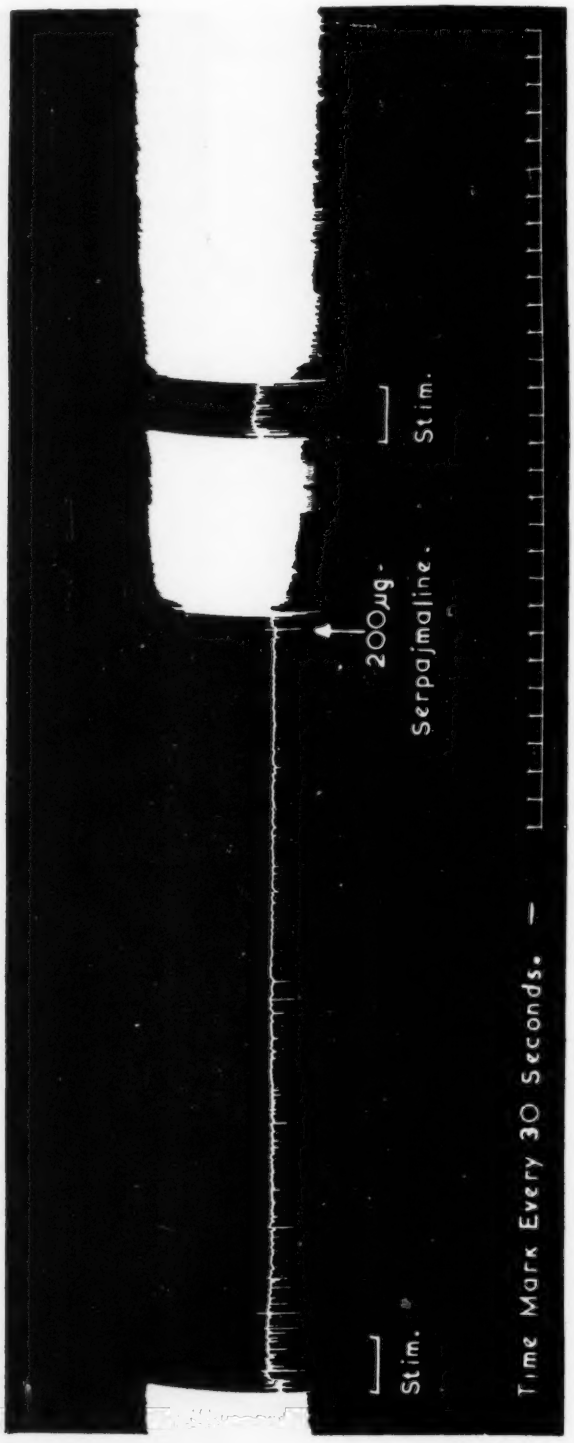


Fig. 5.—Effect of serpajmaline on the isolated perfused fibrillating rabbit heart. At the vertical arrow 200 µg. serpajmaline injected into the perfusion fluid. At "Stim" electrical stimulation applied to the ventricle.

washing the ileum several times with fresh Tyrode solution.

Rabbit Duodenum

Serpajmaline at concentrations of 1.5×10^{-5} did not affect normal peristalsis of rabbit duodenum.

Non-oestrus Rat Uterus

Concentrations of serpajmaline less than 1.5×10^{-5} had no effect on the non-oestrus rat uterus. Higher concentrations (2.5 to 5.0×10^{-5}) immediately produced alternate rhythmic contractions and relaxations of the uterus, which were maintained as long as the serpajmaline remained in contact with it. After washing out the serpajmaline marked increases in the sensitivity of the uterus to the stimulant actions of both carbachol and posterior pituitary extract were observed.

Chick Semispinalis Cervicis Muscle

Serpajmaline had no direct depolarising action on the isolated semispinalis cervicis muscle of the chick. At concentrations greater than 4×10^{-5} it antagonised the depolarising action of decamethonium: in this respect it was 500 times less active than *d*-tubocurarine.

Perfused Beating Rabbit Heart

Doses of serpajmaline less than 200 μg. had no effect on the isolated beating rabbit heart; 200 to 400 μg. slightly decreased the amplitude and reduced the coronary flow for about 3 minutes. The positive inotropic and chronotropic effects of adrenaline were unchanged, but the bradycardia normally produced by acetylcholine was completely abolished and did not return to normal for at least one hour (Fig.4).

Higher doses of serpajmaline (500 to 1000 μg.) produced bradycardia and marked decreases in amplitude and coronary flow.

Perfused Fibrillating Rabbit Heart

Serpajmaline injected into hearts in which fibrillation had been maintained for 15 minutes restored the beat to normal within one or two minutes (Fig.5). The dose required to produce this effect ranged between 100 μg. and 1000 μg., the mean value for 29 hearts being 350 μg.

A qualitatively similar result was obtained with quinidine (mean value 425 μg., range 200 to 800 μg. in 13 hearts).

Rabbit Auricles

Serpajmaline reduces both the normal rate of auricular beat and the maximum rate at which the auricle can respond to electrical stimulation (the effective refractory period). Qualitatively similar results were obtained with quinidine.

Discussion

The pharmacology of serpajmaline is complex, since it is a mixture of carbohydrate with at least five substances, of which three have been identified with known alkaloids.

These three alkaloids, serpentine, serpentinine and ajmaline, have been studied extensively by many workers, and there are wide differences of opinion about their sites and modes of action.

However it is generally agreed that all three reduce blood pressure in the anaesthetised cat and dog, that the fall in pressure is not affected by bilateral vagotomy and that none of the three compounds produces a fall in blood pressure when administered orally to the conscious dog. In addition, all three alkaloids stimulate intestinal musculature and depress respiration, and when injected in high doses into mice they produce convulsions. None of these substances is adrenolytic in the cat, but it is said that serpentinine possesses antiadrenaline activity and abolishes the effects of peripheral vagal stimulation in the anaesthetised dog.

Serpentine possesses slight ganglion blocking activity in the cat, the other two alkaloids being inactive in this respect. Ajmaline is reported to produce a slight rise in the fibrillation threshold in cats, rabbits and frogs without affecting the refractory period or conduction time (for references see 18).

More recently Arora and Madan have investigated the anti-arrhythmic activity of both ajmaline and serpentine and have found both alkaloids more active in this respect than quinidine.[19]

Thus it may be assumed that, though certain pharmacological properties of serpajmaline may be due to its three known constituents, their combined activity cannot account for all its actions.

Serpajmaline, injected intravenously into anaesthetised animals, reduced blood pressure in all the species examined; the dog and the monkey being the most, and the rabbit the least, sensitive of the animals tested.

The blood pressure fall obtained with serpajmaline in the anaesthetised animal is of short duration and is associated with

1. bradycardia
2. block of cardiac responses to peripheral vagal stimulation
3. block and sometimes reversal of the pressor response to adrenaline
4. reduction in the pressor response to noradrenaline
5. reduction in the response of the nictitating membrane to adrenaline
6. variable effect on the response of the nictitating membrane to supra-maximal pre-ganglionic stimulation
7. depression of respiration
8. stimulation of intestinal musculature.

Serpajmaline does not affect the vascular responses to acetylcholine or histamine, neither does it influence the apnoea produced by central vagal stimulation. No depression of blood pressure or respiration is obtained when serpajmaline is injected directly into the lateral cerebral ventricle.

This evidence, and the results of the experiments conducted on conscious animals, suggest that serpajmaline does not depress the central nervous system and has little or no action at the ganglia of the autonomic nervous system. Presumably the fall in pressure produced in anaesthetised animals is more peripheral in origin.

However the fall in blood pressure cannot always be correlated with the anti-adrenaline activity, and it is possible that in some animals serpajmaline produces direct vasodilation.

The cardiac actions of serpajmaline in anaesthetised animals seem to us particularly interesting. Serpajmaline produces bradycardia and yet simultaneously blocks the fall in blood pressure and bradycardia produced by stimulating the peripheral end of the vagus. The bradycardia cannot therefore arise from stimulation of the parasympathetic system or be due to increased sensitivity of the sino-auricular node to normal parasympathetic impulses. It is unlikely that the bradycardia results from decreased sympathetic activity alone, since such a mode of action requires the existence of an intact parasympathetic system.

The results of the experiments on anaesthetised animals and on the isolated perfused rabbit heart preparation indicate that serpajmaline blocks the cardiac actions of acetylcholine without affecting its vascular actions; in this respect it has many similarities with quinidine. Thus many of the actions of serpajmaline in anaesthetised animals may also be obtained with quinidine itself.

Intravenous injections of quinidine sulphate (5 to 10 mg./kg.) in the cat produce a slight short-lasting fall in blood pressure, bradycardia, respiratory depression, blocking of the cardiac actions of peripheral vagal stimulation and reduction in the pressor responses to both adrenaline and noradrenaline, the vascular response to acetylcholine remaining unaltered.

The results obtained with serpajmaline on fibrillating rabbit hearts and on electrically driven auricles show that serpajmaline is more active than quinidine.

Conclusions

1. Serpajmaline is not toxic when administered by the oral route to mice and rats, the LD 50 values being 750 and >1100 mg./kg. respectively.

2. The oxygen consumption rate of mice receiving a daily oral dose of serpajmaline (125 mg./kg.) is not affected after twelve weeks' treatment.

3. The growth rate of mice is slightly depressed ($0.1 > p > 0.05$) after twelve weeks of daily oral dosing with serpajmaline (125 mg./kg.).

4. Serpajmaline is much less active in the renal hypertensive rat, and in anaesthetised animals generally, than it is in the conscious dog.

5. In the anaesthetised animal serpajmaline reduces blood pressure in several ways, of which the most important is probably its anti-adrenaline activity. In some animals a direct vaso-dilator action may occur. Serpajmaline does not possess ganglion-blocking, atropine-like or anti-histamine activity.

6. In conscious mice, rats, rabbits, cats, monkeys, and chicks, serpajmaline has no central sedative, analgesic, neuromuscular-blocking, or anti-cholinesterase activities. It does not affect the activity of barbiturates in mice or the level of serotonin in the brain, the blood sugar concentration or the clotting time in the rabbit.

7. Serpajmaline possesses many of the actions of quinidine, the principal one being a potent antifibrillatory action on the isolated perfused mammalian heart.

Acknowledgements

We express our gratitude to Mr. B. Basil, who performed the experiments on renal hypertensive rats ; to Miss Patricia Sutherland for her work on perfused rabbit hearts ; to Mr. A.J. Clarke who investigated the action of serpajmaline on the isolated rabbit auricles and to Dr. Sarfaraz Siddiqui for assisting in some of the experiments. We are also indebted to Dr. Salimuzzaman Siddiqui for a generous supply of serpajmaline.

References

1. S. Siddiqui, Chem. & Ind. (London), 1270 (1957).
2. S. Siddiqui, Pakistan J. Sci. Ind. Research, **1**, 3 (1958).
3. R. Deininger, Pakistan J. Sci. Ind. Research, **1**, 6 (1958).
4. R. Deininger, Pakistan J. Sci. Ind. Research, **2**, 93 (1959).
5. E. J. de Beer, J. Pharmacol. Expt. Therap., **85**, 13 (1948).
6. G. Woolfe and A. D. Macdonald, J. Pharmacol. Expt. Therap., **80**, 300 (1944).
7. H. Goldblatt et al., J. Expt. Med., **59**, 347 (1934).
8. H. M. Bruce and A. S. Parbes, J. Hyg., **47**, 202 (1949).
9. F. B. Byrom and C. Wilson, J. Physiol., **93**, 301 (1938).
10. D. F. Bogdanski, A. Pletscher, B. B. Brodie and S. Udenfreind, J. Pharmacol. Expt. Therap., **117**, 82 (1956).
11. G. A. H. Buttle and E. J. Zaimis, J. Pharm. Pharmacol., **1**, 991 (1949).
12. W. Feldberg and S. L. Sherwood, J. Physiol. (London), **120**, 3p (1953).
13. L. M. McEwen, J. Physiol. (London), **131**, 678 (1956).
14. G. Dawes. Brit. J. Pharmacol. **1**, 90 (1946).
15. G. A. Ailes and C. H. Ellis, J. Pharmacol. Expt. Therap., **117**, 62 (1956).
16. P. A. Shore, A. Pletcher, E. G. Tomich, A. Carrlsson, R. Kuntzman and B. B. Brodie, Ann. N. Y. Acad. Sci., **66**, 609 (1957).
17. E. G. Tomich, (personal observation).
18. H. J. Bein, Pharmacol. Revs., **8**, 435 (1956).
19. R. B. Arora and B. R. Madan, J. Pharmacol. Expt. Therap., **117**, 62 1956.

ANTIFIBRILLANT ACTION OF THE SERPAJMALINE COMPLEX AND ITS CONSTITUENT ALKALOIDS

R. DEININGER*

Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

In the preceding communication the pharmacological action of the alkaloidal complex serpajmaline,[3,9,10] isolated by S. Siddiqui, [23,24] from the fresh undried roots of *Rauwolfia serpentina* has been described. Serpajmaline, which is free from reserpine and other weaker bases, has a hypotensive action without central side effects. With reference to the antifibrillant cardiac action of serpajmaline,[3] it was considered of interest to study the action of the various alkaloidal and non-alkaloidal constituents of the complex, and the present paper deals with the results obtained from this study.

The fraction serpajmaline includes ajmaline, serpentine and serpentinine, two unknown compounds and a carbohydrate-like substance. Ajmaline belongs to the tertiary indoline alkaloids; serpentine and serpentinine belong to the quarternary and hydronium bases. The three alkaloids ajmaline, serpentine and serpentinine were isolated by S. Siddiqui and R. H. Siddiqui.[20,21,22] These alkaloids have been studied extensively by many workers and there are wide differences of opinion regarding their sites and modes of action. It is generally agreed that serpentine reduces blood pressure,[14,16,11,7,19] is a more active substance than ajmaline[13] and more toxic than ajmaline and serpentinine.[5] Its hypotensive activity is probably due to acute vasodilatation.[19] The pressor effect of adrenaline was reduced to about the same extent as after equal doses of ajmaline.[2] There is a discrepancy in the description of the blood pressure effect of serpentinine and ajmaline. Chopra and coworkers [5,6,11] observed that ajmaline and serpentinine raised the blood pressure, while other workers found that both alkaloids have a weak hypotensive action [1,15,16,17] and do not contribute much to the hypotensive activity of an alkaloidal mixture.

Method

The importance of potassium concentration for the occurrence of heart fibrillation became evident both for auricular and ventricular fibrillation. The fibrillation occurs when the potassium concentration of the solution is reduced.[12]

Isolated Rabbit Heart (Langendorff method).—After fixing the electrodes on the tip and the base of the heart, ventricular fibrillation was produced by electric stimulus: stimulation for 2 to 4 minutes, frequency 200-400, 5-10 mA, sharp rectangular impulses. If the fibrillation was not arrested by itself within 5 minutes after that, the fibrillation lasted for a longer period (40-60 minutes). After 10 minutes fibrillation a control solution was injected and 5 minutes later a solution of the drug was introduced via a polythene cannula opening near the coronary arteries to the perfusion fluid.

Perfusion Fluid.—McEwen solution with lower potassium chloride content and without sodium dihydrogen phosphate: sodium chloride, 7.6 g.; potassium chloride, 0.24 g.; calcium chloride, 0.19 g.; sodium bicarbonate, 2.1 g.; dextrose, 2.0 g.; sucrose, 4.5 g.; aqua dest., 1000 ml.

Isolated Dog Heart.—After perparing carotid artery and jugular vein of an anaesthetised dog (narcosis: chloralose 80 mg./kg. i.v., or pentothal 15 mg./kg. + phenobarbitone 25 mg./kg. i. v., and phenobarbitone 75 mg. / kg. intraperitoneal),

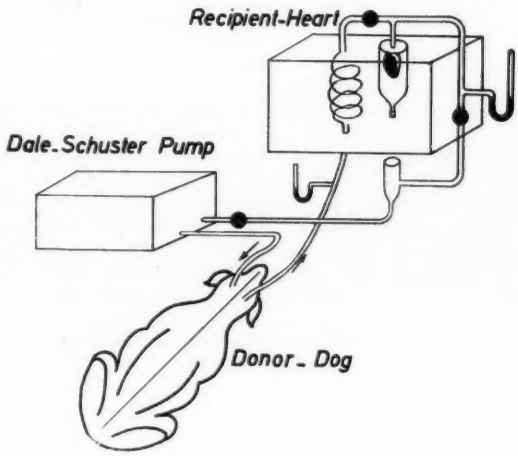


Fig. 1.—Arrangement of an isolated perfused dog heart connected with the circulation of second anaesthetised dog. The blood flow coming from the carotid artery passes: (1) mercury manometor; (2) spiral in isolated organ bath; (3) isolated dog heart; (4) blood reservoir; (5) Dale - Schuster pump; and (6) jugular vein. A second direct connection is between isolated heart and blood reservoir, passing a second mercury manometer registering the pressure in the aorta of the isolated heart.

*Present address: Toepferstr. 21, Utersen/Holstein, Germany.

the aorta of an isolated dog heart is connected with the circulatory system of the anaesthetised dog between the carotid artery and the jugular vein (see Fig. 1). The blood then circulates from the carotid artery of the donor dog and passes a spiral of the organ bath (37 °C.) via a two way cannula either to the isolated heart through the coronaries, blood reservoir, Dale-Schuster pump and back to the jugular vein of the donor dog (=way I), or directly to the blood reservoir (=way II). Two mercury manometers are connected in this system, the one showing the blood pressure of the anaesthetised dog (donor dog), and the other the pressure in the recipient heart.

The preparation is done in the following manner:

(1) The two cannulas of the system are connected with the carotid artery and the jugular vein. The whole system is closed, except for the blood pressure manometer which is kept open.

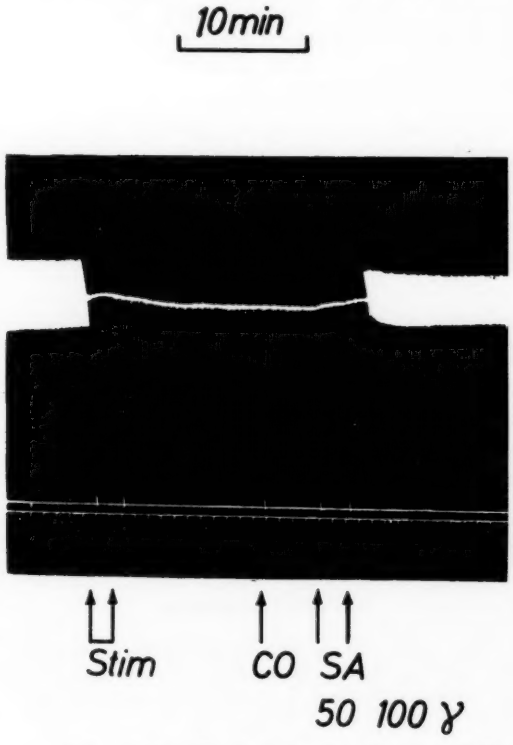


Fig. 2.—The effect of serpajmaline (SA) on a fibrillating rabbit heart after electrical stimulation (STIM). Thirteen minutes after fibrillation has started, a control solution (CO) was injected, afterwards serpajmaline was given, 100 γ was effective. Above: isolated heart. Below: signal and time (1 min.).

(2) The way II of the recipient system is then opened slowly to the extent the Dale-Schuster pump 1.5 ml. at a frequency of 80/min. can pump away by steady level in the blood reservoir. (3) After 10 minutes, the isolated heart (recipient heart) is prepared and immediately connected with the heart cannula. As the way I through the recipient heart is opened, the way II is simultaneously reduced to bring the pressure in the aorta of the recipient heart to 50-60 mm. Hg.

The recipient heart is connected with an isometric writing lever. Fibrillation is induced in the perfused beating recipient heart by electrically stimulating the ventricle. Fibrillation always appeared after short stimulation (10-30 seconds). Frequency, 200-700/sec.; duration, 0.75 msec.; 1-10 mA.; stimulus, sharp rectangular. The fibrillation persisted for periods of 60-120 min.

Results

As already described[3] serpajmaline arrested the fibrillation of the isolated rabbit heart immediately after the injection of 100-300 γ (see Fig. 2), average value 182 γ (14 hearts). Repeated attemps to reinduce fibrillation by electrical stimulation during the first hour after the injection of serpajmaline were unsuccessful.

Following the technique described above, fibrillation was induced in the isolated dog heart by electric stimulus, and about 10 minutes later a solution of serpajmaline (4 mg./kg.) was injected into the V. femoralis of the donor dog. After a

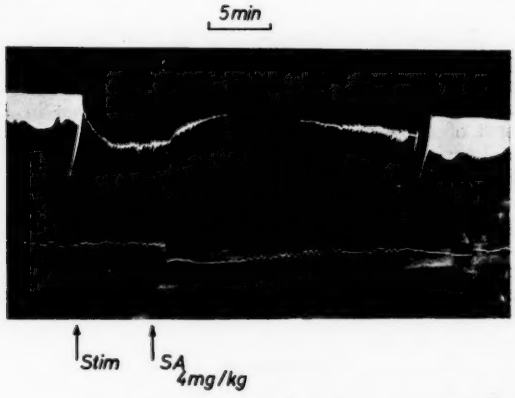


Fig. 3.—The effect of serpajmaline on the fibrillating isolated dog heart injected intravenously to the donor dog. The isolated dog's heart is connected with the circulation of a second anaesthetised dog. The isolated dog heart was electrically stimulated (STIM) till fibrillation appeared. Seven minutes after fibrillation started, serpajmaline (SA) 4 mg./kg. was injected intravenously to the donor dog. Twenty minutes after injection the fibrillation of the isolated heart was arrested. Above: isolated dog heart (recipient). Below: blood pressure in the system.

latent period of 20-25 minutes the fibrillation was completely arrested. The latent period may be taken as the time the drug takes to flow into the recipient heart after passing the artificial circulatory system. This finding shows that serpajmaline exercises its antifibrillant action well within the range of therapeutic dosage (see Fig. 3).

During a few of these experiments the recipient heart showed irregularity and partial block on its own without any artificial manipulation. After injection of 2 mg. serpajmaline into the heart via cannula, the heart in such cases recovered immediately and the rhythm was normalised.

It was of further interest to clear up the question if any of the alkaloids in serpajmaline is responsible for the heart action. The following bases and combinations have been investigated: (1) the total basic fraction of the serpajmaline complex; (2) the non-basic fraction of serpajmaline containing sugars and sugar acids and chlorides; (3) the alkaloids: ajmaline, serpentine and serpentinine; and (4) serpajmaline with the addition of 10-20% of ajmaline.

The following results were obtained on the isolated rabbit heart:

The basic fraction of serpajmaline showed an antifibrillant action with 50 to 100 γ (8 hearts).

The non-basic fraction of serpajmaline arrested fibrillation in an average dose of 217γ (ranging 100-300 γ) (6 hearts).

Ajmaline in an average dose of 63 γ, ranging 25-100 γ (8 hearts), and serpentine in an average dose of 200 γ (9 hearts) have both got an antifibrillant action. Serpentinine was ineffective even in doses of 600γ. K. J. Child [4] could confirm the results with ajmaline, serpentine and serpentinine. He also found ajmaline and serpentine to exercise an antifibrillant action on the isolated auricle.

In experiments with serpajmaline with added ajmaline it was observed that this combination arrests fibrillation in an average dose of 26 γ ranging between 6.125 and 75γ (16 hearts).

Discussion

Recently it was found that the combined activity of the known alkaloidal constituents of serpajmaline, (ajmaline, serpentine and serpentinine) cannot account for all its actions.[3] In the present investigation also it has been observed that the antifibrillant action of serpajmaline is not only due to ajmaline and serpentine, as its non-basic fraction has this action too. Ajmaline is 2-3 times more active than serpajmaline. Serpentine acts quantitatively similar to serpajmaline. The alkaloid content of serpajmaline is 35 to 40% depending upon the age of the root. From the results obtained so far on the chemical side of investigations, it would appear that, if ajmaline and serpentine only were to be responsible for the antifibrillant action, this action should be still stronger in comparison with that of serpajmaline. It has moreover been shown that the non-basic fraction of serpajmaline has likewise an antifibrillant action in a dose of 100 to 200γ , and the action of serpajmaline is intensified with the incorporation of 20% ajmaline. In fact this combination arrests fibrillation in most cases with a dose of 6.125 to 12.25 γ as against 182γ of serpajmaline, and this intensification of action cannot be accounted for on a merely addition basis.

Conclusion

Serpajmaline and the alkaloids ajmaline and serpentine contained in this complex have an antifibrillant action on the isolated rabbit heart. Ajmaline is more active than serpentine. Serpentinine is inactive.

The heart action of serpajmaline does not depend only on its alkaloidal content ajmaline and serpentine.

The non-basic fraction and the basic fraction of serpajmaline have both an antifibrillant action on the isolated perfused rabbit heart. The basic fraction was more active than the non-basic fraction of serpajmaline.

The addition of ajmaline to serpajmaline strongly potentiates its antifibrillant action.

With a newly developed method for testing the heart action, which consists in connecting the isolated dog heart with the circulatory system of a second anaesthetised dog, it has been demonstrated that serpajmaline arrests the heart fibrillation in therapeutic dosage (4 mg./kg. intravenously).

Acknowledgement

The author takes this opportunity to express his thanks to Drs. M. Ikhlas Khan, Saleem Mir and M. Harun-ur-Rashid for their assistance in the course of the present work.

References

1. Bein and Gross, Verhandl. deut. Ges.

Krebsforschg., **19**, 277 (1954).
2. Chatterjee, Bose, Das Gupta, Roy and Werner, Bull. Natl. Inst. Sci. India, **4**, 31 (1955).
3. Child, Davis, Sharpe, Tomich and Deininger, Pakistan J. Sci. Ind. Research, **2**, 99 (1959).
4. K. J. Child, private communication.
5. Chopra and Chakaravarti, Indian J. Med. Research, **29**, 763 (1941).
6. Chopra, Bose, Gupta and Chopra, Indian J. Med. Research, **30**, 319 (1942).
7. Chopra, Das, Mukherjee, Indian J. Med. Research, **24**, 1125 (1937).
8. Cronheim, Stipp and Brown, J. Pharmacol. Exptl. Therap., **110**, 13 (1954).
9. Deininger, Pakistan J. Sci. Ind. Research, **1**, 6 (1958).
10. Deininger, Pakistan J. Sci. Ind. Research, **2**, 80 (1957).
11. Gupta, Report of the Adviser, School Board, Indian Research Fund Association, 1942, p. 70.
12. Holland and Burn, Brit. Med. J., **1**, 1031 (1957).
13. Nelson and Schlegel, J. Am. Pharm. Assoc., Sci. Ed., **42**, 324 (1953).
14. Raymond-Hamet, Compt. rend. Soc. biol., **134**, 369 (1940).
15. Raymond-Hamet, Willd. Bull. Sci. Pharmacol., **43**, 364 (1936).
16. Raymond-Hamet, Compt. rend. Soc. biol., **134**, 94 (1940).
17. Raymond-Hamet, Compt. rend., **211**, 414 (1940).
18. Raymond-Hamet, Compt. rend., **223**, 927 (1940).
19. Rubin and Burke, J. Pharmacol. Exptl. Therap., **110**, 44 (1954).
20. S. Siddiqui and R. H. Siddiqui, J. Indian Chem. Soc., **8**, 667 (1931).
21. S. Siddiqui and R. H. Siddiqui, J. Indian Chem. Soc., **9**, 539 (1932).
22. S. Siddiqui and R. H. Siddiqui, J. Indian Chem. Soc., **12**, 37 (1935).
23. S. Siddiqui, Chem. Ind., 1270 (1957).
24. S. Siddiqui, Pakistan J. Sci. Ind. Research, **1**, 3 (1958).

CULTURE AND PROPAGATION OF RAUWOLFIA SERPENTINA, BENTH. IN EAST PAKISTAN

S. Hedayatullah

Dacca

Status of Supplies

The world-wide reputation of *Rauwolfia serpentina* in the treatment of hypertension and mental ailments has brought in its train the question of commercial availability of the roots of the plant. So far the roots have been mostly collected from the natural wild growth of the plant, and Java and India have been the main supply sources of the drug. Due to heavy and irresponsible collection, however, it is reported that Java has been denuded of the plant, and the Balai Penjelidekan Thenik Pertanian Bogor are lately taking measures for its restoration in the island.

Rauwolfia serpentina also occurs in Ceylon, Burma, Siam, Sumatra, the Andaman Islands, and East Pakistan, but the roots obtained from these countries vary in the relative content of their individual and total alkaloids. Although this variability has some effect on the biological activity, the material from these countries definitely is usable provided it is properly identified.[1]

A. J. Feuell in his paper[2] on the genus *Rauwolfia* stated, that the future was likely to see a steady and probably increasing demand of *Rauwolfia* roots, and to meet this demand several lines of development were suggested, viz., (a) fostering of existing growths and cultivation in the districts where the plant is indigenous in order to supplement wild material, (b) exploitation of plants from areas hitherto untapped, (c) use of alternative species as sources of reserpine and possibly of other alkaloids, (d) chemical and pharmacological study of species not so far examined.

In India, the Forest Department have arranged to survey the Indian forests with reference to (a), but the results of the survey have not yet been published. In Pakistan also, a grant was sanctioned by the Pakistan Council of Scientific and Industrial Research to the Dacca University for the survey of medicinal plants including *Rauwolfia*. The result of this survey has not yet been published either. We are thus still very much in the dark about the extent of the sources of *Rauwolfia* roots for commercial exploitation in tonnage requirement from the wild natural growth of the plants.

Necessity of Cultivation

Although it may be possible for a country with sufficient natural growth of the plant to rely on this source, for high tonnage requirement and uniform supply of the material, recourse to planned cultivation of the *Rauwolfia* species would be desirable. Consequently, even in India, cultivation of the species has been started and reported yields vary from 1000 to 2000 lbs. per acre.

On the basis of published information on the culture of *Rauwolfia serpentina* and or other species, certain broad facts can be summarised as follows:- (i) Propagative materials are seeds, root cuttings and stem cuttings. (ii) Germination of the seeds varies from 25% to 40% , the fresh seeds giving better results than the old. (iii) A light well-drained soil with a top-dressing of farmyard manure provides the best conditions for cultivation. (iv) From its far flung geographical distribution and its manifest edaphic tolerance, one may expect *Rauwolfia* to lend itself readily to successful cultivation under a wide range of conditions.

The necessity for the cultivation of *Rauwolfia serpentina* in Pakistan has assumed increasing importance with recent researches on the serparation of more active substances from the root material.[3,4] *Rauwolfia serpentina* grows wild in East Pakistan, but with the increasing demand the natural sources will be rapidly depleted. The plants do not occur gregariously but are widely scattered. This would make for a high collection cost and also render plant liable to extinction in the course of a few years. To meet this difficulty and ensure regular supplies of a uniform quality, it would be necessary to encourage large scale cultivation of the species for commercial exploitation.

Experimental Cultivation in Pakistan

In view of the considerations referred to above, a scheme "Investigation into the Possibility of Culture of *Rauwolfia serpentina*, Benth." was submitted by the author to the Pakistan Council of Scientific and Industrial Research in 1954. The scheme was sanctioned and is now in its fourth year. The results of investigations carried out in the experimental plantation under this scheme are summarised below:-

1. Experiments to study the yield of roots under three different spacings between plants, viz., (a) 1′×1′, (b) 1½′×1′, and (c) 2′×2′, have

shown that the spacing of 1½′×1′ is most suitable for the cultivation of *Rauwlfia serpentina*, keeping in view the yield of roots and interculture operation. This spacing is now being practised here and is recommended to other growers of *Rauwolfia serpentina* plants. The spacing gives a yield of 1500 to 3000 lbs. of roots per acre.

2. For the vegetative propagation of the plants of *Rauwolfia serpentina*, stem, root and leaf cuttings have been experimented with. It has been found that while both stem and root cuttings can be used successfully for the vegetative propagation of the species, the leaf cutting has no propagative value. Five hundred and forty pieces of stem cuttings were planted in plot 4, on 8th and 9th June 1958. The cuttings sprouted but, due to an unexpected spell of drought, most of them died later on. Following this, another 300 pieces of stem cuttings were planted and started sprouting. Ultimately 30 cuttings established themselves into full-fledged plants, giving 10% success. In 1959, with the advent of the northwester (April), 625 stem cuttings were planted. Out of these cuttings 72 could establish themselves into full-fledged plants, giving 12% success. At the same time 10,000 root cuttings were planted, and it was observed that 2,771 sprouted and produced as many established plants, so that here the success was 36%. From our observations on the sprouting of the stem and root cuttings carried out so far, it may be concluded that root cuttings are better propagative material of the plant than the stem cuttings.

3. For the propagation of the plants of *Rauwolfia serpentina* with seeds, freshly ripened fruits, dried fruits and peeled seeds (i.e. the seeds in three different states) were used in order to determine their relative suitability. These experiments established that the peeled seeds are most suitable for propagation. They germinate quickly and the percentage germination of the seeds is also high. The peeled seeds are therefore now being used by us for the propagation of the plants.

Sowing Time for Optimum Germination

Germination tests on the seed of *Rauwolfia serpentina* have been carried out all round the year by monthly sowing to determine the most suitable time of the year which gives a maximum percentage germination of the seeds of this species. The results obtained so far are shown in the table. Allowing for variations due to non-determinable factors, it may be concluded from the data presented in this table that sowing in the period immediately preceding the monsoon (i.e. March and April) gives the lowest percentage germination, the optimum germination being obtained in the closing months of the monsoon with a record of 48% in July.

Date of sowing	No. of seeds sown	Date of germination	Time of germination*	No. of seedlings	Percentage
1.9.1957	1640	18.9.1957	17 days	225	14%
1.10.1957	500	18.10.1957	17 ,,	125	25%
1.11.1957	500	21.11.1957	20 ,,	120	24%
9.12.1957	200	31.1.1957	22 ,,	40	20%
13.1.1958	500	3.3.1958	53 ,,	100	20%
3.2.1958	400	13.3.1958	39 ,,	85	21%
1.3.1958	500	24.3.1958	23 ,,	42	8%
1.4.1958	500	3.5.1958	32 ,,	50	8%
1.5.1958	500	19.5.1958	18 ,,	72	14%
1.6.1958	500	21.6.1958	20 ,,	50	10%
1.7.1958	500	17.7.1958	16 ,,	240	48%
1.8.1958	500	15.8.1958	14 ,,	136	29%

*It may be noted that although a definite number of days has been given as 'the time of germination', it has been observed that the seeds continue to germinate for much longer periods, so much so, that even after an interval of a year, seedlings have been known to appear in the seedbeds.

Besides this trial, the seeds of *Rauwolfia serpentina* were also germinated for transplantation of seedlings. Four thousand nine hundred seeds of this species were sown in the seedbeds in April 1958 and were found to take 18 to 30 days for germination. The maximum and minimum percentages of germination in the various seedbeds were 16 and 5, respectively, while the average was 12. The corresponding data for percentage germination of 26,200 seeds sown in the month of May are: maximum 64% and minimum 13% with an average of 35%.

Further with the advent of the northwester and during the current monsoon, i.e. from May to July 1959, altogether 38,180 seeds were put to seedbeds for germination to obtain seedlings for transplantation in the fields used for the scheme "Large Scale Plantation of *Rauwolfia serpentina*." It was observed that during the month of May the time of germination was 13 days, the maximum germination was 45%, minimum was 37% and the average 41%. Similarly, during the month of June when 24,410 seeds were put to seedbeds, the maximum germination was 75%, the minimum 31% and the average 50%, and the time of germination 10 days. Again during the month of July when 7,200 seeds were put to seedbeds, the

maximum germination was 66%, the minimum 63%, and the average 65%, the time of germination being 12 days.

The above data from 1st September 1957 to 31st July 1959 shows that the germination of the seeds is rather erratic. This is because the process of germination was taking place under the natural conditions of moisture, temperature and aeration and other soil conditions existing at the time in the seedbeds. To obtain consistent values of germination percentage of the seeds, the germination must be conducted under uniform and controlled conditions of temperature, moisture, aeration and substratum, which can only be obtained in a modern type of "Scientific germinator".

Conclusions

These variations do not vitiate the main conclusion that the best time for obtaining seedlings of *Rauwolfia serpentina* is to start the seedbed sowing in the beginning of May, i. e. with the advent of the northwester, and continue the operation throughout the monsoon and even till October. Of course, the higher average percentage germination will be obtained during the four months of the monsoon, i. e. May, June, July and August.

As to the comparative efficiency of the propagative materials, it is concluded from our observation so far that the peeled seeds are the best material, and among cuttings, the root cuttings are better than the stem cuttings while leaf cuttings have no propagative value.

Some useful instructions for prospective cultivators are given in the Appendix.

Acknowledgements

The author is greatly indebted to Dr. Salimuzzaman Siddiqui, Director, Pakistan Council of Scientific and Industrial Research, Karachi, whose kind and constant interest, made it possible to obtain funds for the scheme and to make the progress reported to date. The author's thanks are also due to the coworkers who have helped in carrying out the experiments.

References

1. E.F. Woodward, Drug & Cosmetic Ind., April 1956.
2. A.J. Feuell, Colonical Plant and Animal Prods. (Gt. Brit.), **1**, 1-33 (1955).
3. S. Siddiqui, Pakistan J. Sci. Ind. Research, **1**, 3 (1958).
4. R. Deininger, ibid., **1**, 6 (1958).

Appendix: Instructions for Cultivation

On the basis of experience gained in the course of investigations described in the paper, the following instructions are offered for the cultivation of *Rauwolfia serpentina* in East Pakistan and similar climatic areas.

(*i*) *Preparation of Seedbeds*

(a) The site of a seedbed should be so selected that the land is free from waterlogging and receives ample sunshine and air. A site having east and south ends open would be most suitable.

(b) The site should be cleaned and freed from grass roots and roots of other plants, and then dug up to a depth of at least 9″ by a 'kodali' or a shovel. Cow dung or farmyard manure and leaf mould should be mixed with the dug-out soil and the seedbeds prepared to fine tilth. In a seedbed of 10′×5′, one maund of the manure and one maund of leaf-mould should be mixed.

(*ii*) *Sowing of Seeds*

After the preparation of the seedbed, the seeds should be sown in lines 4″ apart between lines and 2″ apart in the line. The seeds should not be sown very deep, a depth of about 1/2″ being suitable. After sowing the seeds in the lines, the surface of the seedbed should be smoothed by hand. Thereafter, the beds should be copiously watered. During the monsoon, it may not be necessary to water the beds frequently, but if there is no rain for several days, the watering should be repeated. During the monsoon, the seeds should start germinating after a fortnight, but in the dry period and in the cold season, germination takes longer, some times as long as six weeks. Similarly, in monsoon the percentage of germination is very high going upto a maximum of 80%, but deteriorates as the season gets drier and colder. Usually one seed per hole is sown, and about 1 lb. of seed is needed for a seedbed of the dimensions given earlier.

(*iii*) *Care of the Seedbeds during Growth of the Seedlings*

Particular attention should be given to keep the seedbeds free from any weed, grass, etc., even after the seeds have germinated. It has been found that if a seedbed is not kept free from weeds, the germination is very poor, and the seedlings succumb to superior competition of grasses and weeds. It is essential for best results that the seedbed should be kept neat and clean from the very day of seed sowing till the seedlings are removed

for transplantation. Besides this care of the seedbeds, they should be watered whenever required, keeping in mind that they must never be allowed to get bone-dry and hard. The seedlings will be ready for transplantation when they are six weeks old and have six to eight leaves.

(*iv*) *Preparation of Site for Transplantation of the Seedlings*

As *Rauwolfia serpentina* cannot tolerate any water logging, the kind of field on which tea is grown should be ideal for *Rauwolfia serpentina* plants; it can be grown not only on valley land but also on the slope of the hill.

Before transplanting, the area to be transplanted with seedlings should be selected and prepared. It should be freed of weeds and grass and then one handful of mixed manure should be put in each hole. The mixed manure is prepared by thoroughly mixing one maund of rotten cow-dung, ½ maund of bone meal, 2½ seers of ammonium sulphate, and one maund of leaf mould, to be thoroughly mixed before application. After putting the mixed manure in each hole, the site will be ready for transplantation of the seedlings.

(*v*) *Uprooting the Seedlings (from the Seedbed) for Transplantation*

Before removing the seedlings, the seedbed should be watered so as to moisten the soil. The seedling should be removed not by 'pulling', but with the help of a 'niri' or 'khurpi', starting from one end of each line.

Starting from one end of the seedbed, the seedlings should be lifted gradually, one at a time, with minimum disturbance of the roots and keeping some lumps of soil adhering to the roots of the seedling in order to avoid injury to the roots. Seedlings thus lifted should be arranged on a tray. Care should be taken not to expose the seedlings to the strong light of the sun. If they are to be stored before planting, this storage should be in a cool, shady place, and if necessary they should be sprayed with water by mist sprayer. The best time for transplantation of seedling is early morning or late afternoon.

(*vi*) *Transplantation*

As the plant is small and has a weak stem, it has a sort of straggling habit. It has been found by experiment that the best method of planting is 1½′ apart between lines and 1′ apart in lines.

On the site selected for the plantation, lines 1½′ apart should therefore be drawn, preferably in the north to south direction. Then on each line holes should be dug one ft. apart. After the seedlings have been brought on the site of the transplantation field, individual seedlings should be placed and arranged one in each of the holes in the lines. Then the seedlings should be carried in the holes with the ball of the earth along with their roots up to the first pair of leaf from the ground and the soil round the root of seedlings tightly pressed. When transplantation is completed, the transplanted seedlings should be watered. After this, if there is a shower of rain each day or on alternate days, watering would not be necessary, but during a droughty period watering is essential.

It may be mentioned here that cloudy and drizzly days are preferred for the transplantation of seedlings. In such weather transplantation can be carried out throughout the day.

(*vii*) *Care after Transplantation*

The transplanted lines and especially the region around each plant should be kept free from weeds and grasses during the early stage of the growth of plants, and in order to give a neat and tidy appearance to the plantation, the space (about 1′) between plants in the lines should also be freed from untidy growths, especially during the early stage of growth of the plantation. Mulching of the root region of each line should be done once in a fortnight or in 3 weeks. Any gaps due to the withering of transplanted seedlings should be filled up by transplanting fresh seedlings. Generally it takes the seedlings 3-4 days to recover from the shock of transplantation, and within a week the plantation should look as established. As the plant grows in height, it will straggle due to the weak nature of the stem, and it will be necessary to put earth in the root region to make a ridge, the lines containing the plants would be ridges and the space between the lines would be furrows. The plants will start flowering when they are about 3 months old, and the flowering and fruiting would be continuous. For future plantation, the seeds (which are blackish when ripe) should be collected and seeds extracted regularly.

(*viii*) *Harvesting*

It has been found by experiments that the most economical harvesting age in respect of yield per acre and alkaloidal content is between 12 months and 18 months after transplantation. It has been estimated from our experimental plots that the yield of roots varies between 1500 lbs. and 3000 lbs. per acre.

It must be mentioned here that in the foregoing description seeds have been considered as the propagating material. However, *Rauwolfia* plants can also be propagated by root cuttings and stem cuttings, and therefore replantation of harvested plantations should not be a very difficult matter, at least in comparison to a fresh plantation, because in harvesting (during the process of digging and uprooting of plants) quite a number of ends of roots are bound to remain in the soil. These bits of roots will germinate and shoot out new plants as soon as they get suitable moisture and temperature conditions with the onset of the monsoon. Quite a number of ripe fruits will also drop underneath each plant and these too will germinate as soon as they get proper conditions for their germination. What will be necessary to complete a replantation is to fill up the gaps among these self-sown plants by fresh seedlings at the proper time and season.

BIBLIOGRAPHY ON RAUWOLFIAS

A. R. Ghani and Akhtar H. Siddiqui

Pakistan National Scientific and Technical Documentation Centre, Karachi

Rauwolfia serpentina and the drugs obtained from it and some of the other *Rauwolfia* species have now acquired high importance in the field of medicine. The present bibliography has been prepared as a compliment to the papers presented in this special issue. This bibliography incorporates the references previously published in Miscellaneous Publication No. 4 of the Pakistan Association for the Advancement of Science, compiled by A. R. Ghani, and includes over 2,000 references.

For the reader's convenience in searching the extensive literature in this field, the references are grouped under the following broad subject headings:

I. General, Botany and Pharmacognosy;

II. Chemistry;

III. Pharmacology and Therapeutics.

Within each section the references are arranged alphabetically according to the names of the authors.

I. GENERAL, BOTANY AND PHARMACOGNOSY

Abrol, B. K. et al. Propagation of *Rauvolfia serpentina* in Jammu and Kashmir State. *Indian J. Pharm.*, 1956, **18**, 169-70.

Ahyi, R.M. On the pharmacopoeia and healing in West Africa (in French). *Bull. Centre Res. agron. Bingerville*, 1954, **9**, 53-67 (incl. ref. to *R. vomitoria*).

Ainslie, W. Materia Indica, or some account of those articles which are employed by the Hindoos and other eastern nations in their medicine, arts and agriculture. 2 vols. London, 1826. (*R. serp.*, Vol. II, p. 441).

Allen, E. F. Notes on the cultivation of *Rauwolfia* in Malaya. *Malayan agric. J.*, 1958, **41**, 100-105.

Atal, C. K. and Schwarting, A. E. A pharmacognostic study of *R. decurva*, Hook. *Amer. J. Pharm.*, 1956, **128** (11), 365-74.

Auster, F. *Rauwolfia* in the homoeopathic literature. *Planta Med.*, 15 Dec. 1957, **5**(56), 194-197.

Badhwar, R. L. and Mukerji, B. *Rauwolfia serpentina* Benth. ex. Kurz (Indian Council ot Agricultural Research Special Pamphlet), New Delhi. (forthcoming publn.).

Badhwar, R.L. et al. *Rauwolfia serpentina*: Further studies on methods of propagation and their effect on root production. *Indian Forest Leaflet No. 158*, (Minor Forest Products), Dehra Dun, 1957, 7 pp.

Badhwar, R. L. et al. *Rauwolfia serpentina*: Methods of propagation and their effect on production and alkaloidal contents of roots. *Indian Forest Leaflet No. 148*, Dehra Dun, 1956, 7 pp.

Badhwar, R. L. et al. *Rauwolfia serpentina*: Methods of propagation and their effect on root production. *Indian J. Pharm.*, 1956, **18**, 170-75; (also in Symposium on *Rauwolfia:* Abstracts of Papers, Lucknow, 1955, pp. 7-8).

Badhwar, R. L. et al. *Rauwolfia serpentina*—The wonder drug of India (*Rauwolfia sarpagandha*). *Indian For.*, 1955, **81**, 258-68; (also in *Indian Forest Leaflet No. 104/1955*. Dehra Dun, 10 pp.).

Bal, S. N. Pharmacognostic standards of *Rauwolfia serpentina*, Benth. *Indian J. Pharm.*, 1956, **18**, 175-78; (also in Symposium on *Rauwolfia:* Abstracts of Papers, Lucknow, 1955, pp.8-9).

Bhatnagar, S. S. *Rauvolfia* problem. *Indian J. Pharm.*, 1956, **18**, 114-116.

Bianco, J. M. and Buamrucker, J. Preliminary botanical and chemical report on *Rauwolfia pernifolia* (in Portuguese). *Rev. bras. chim.*, Feb. 1956, **41**, 124.

Biswas, K. Cultivation of *Rauvolfia* in West Bengal. *Indian J. Pharm.*, 1956, **18**(6), 227-32; (also in Symposium on *Rauwolfia:* Abstracts of Papers, Lucknow, 1955, p.8).

Biswas, K. *Rauwolfia canescens*. Indian Council of Agricultural Research Special Pamphlet, New Delhi. (forthcoming publn.).

Biswas, K. *Rauwolfia* drug. *Sci. & Cult.*, 1953, **18**(12), 579-81. (Description of *R. serp.* and *canescens*).

BONTIQUE, R. and MANSEUR, X. Alkaloids of the genus *Rauwolfia* and botanical studies on the species occurring in the Belgian Congo (in French). *Bull. agric. Congo Belge*, 1955, **46**(2), 271-80.

BRAECKMAN, P. Contribution to the pharmacognostic knowledge of *R. vomitoria Afz.* (in French). *Pharm. Tijdschr. belge*, 1956, **33**(5), 105-10.

BRAHMACHARI, U. N. *Rauwolfia serpentina.* (in "Progress of medical research work in India during the past 25 years," p.652). *Progress of Science in India during the past 25 years.* Indian Science Congress Association, Calcutta, 1938.

British Pharmaceutical Codex, London. Pharmaceutical Press, (*R. serp.* 1949 ed., pp. 762-63; 1954 ed., pp. 648- 49).

BURKILL, I. H. Dictionary of the economic products of the Malaya Peninsula. London, 1935. (*R. perakensis*, vol. 2, p. 1885).

CANTORIA, MAGDALENA and YOUNGKEN, H. W. Observations on *R. vomitoria* Afz. *Amer. J. Pharm.*, 1955, **127** (8), 270-81; *J. Philipp. Pharm. Ass.*, 1955, **42**, 235-259.

CHAKRAVARTY, H.L. Revision of Indo-Burmese *Rauwolfia. Bull. bot. Soc. Beng.*, 1955, **9** (1), 1-9.

CHAKRAVARTY, M.D. and DATTA, S.C. Pharmacognostic and parmacological investigations of the roots of *R. canescens Linn.* (Abst.). *Proc. Indian Sci. Congr.*, 1953, **40**(3), 63.

CHANDRA, V. Cultivation of *Rauwolfia serpentina*, Benth. *Sci. & Cult.*, 1956, **21** (10), 601.

CHANDRA, V. Inducing rooting in stem cuttings of *R. canescens* L. (*Lett.*). *Sci. & Cult.*, 1956, **22** (2), 101.

CHANDRA, V. Leaf-spot disease of *Rauwolfia serpentina*, Benth. *Sci. & Cult.*, Oct. 1955, **21**(4), 208-10.

CHANDRA, V. Occurrence of *Rauwolfia serpentina*, Benth. in forests of Western Circles, Uttar Pradesh. *J. Indian bot. Soc.*, 1957, **36**, 519-522.

CHANDRA, V. Occurrence of tricarpellary fruit of *Rauvolfia serpentina*, Benth. *Sci. & Cult.*, 1956, **22**(3), 181.

CHANDRA, V. Studies on *Rauvolfia*. *J. sci. industr. Res.*, 1956, **15A**(3), 125-133. (Varieties, cultivations, etc.).

CHANDRA, V. Studies on *Rauvolfia*. I. Propagation of *R. serpentina*, Benth. II. Preliminary studies on floral biology of *R. serpentina*, Benth. III. Morphological studies of *R. canescens*, L. IV. Root-knot disease of *R. serpentina*, Benth. V. Alternaria on *R. serpentina*, Benth. *Indian J. Pharm.*, 1956, **18**, 132-47; (also in Symposium on *Rauvolfia:* Abstracts of Paper, Lucknow, 1955, p. 4).

CHANDRA, V. Studies on root development of *Rauvolfia serpentina*, Benth. *J. sci. industr. Res.*, 1955, **14C**(1), 36.

CHANDRA, V. Vegetative propagation of *R. serpentina*, Benth. *Sci. & Cult.*, 1955, **20** (11), 554-55.

CHANDRA, V. Vegetative propagation of *Rauvolfia serpentina*, Benth. *J. sci. industr. Res.*, 1954, **13A**, 187.

CHATTERJEE, D. Correct spelling of *Rauvolfia*, with a note on Rauwolf. *Sci. & Cult.*, 1956, **22**, 242.

CHOPRA, R.N. Indigenous drugs of India, their medicinal and economic aspects. Calcutta, 1933. (*R. serp.*, p. 373).

CHOPRA, R.N. and CHOPRA, I. C. A review of work on Indian medicinal plants, including indigenous drugs and poisonous plants. (*Indian Council of Medical Research, Spl. Reports Ser. 30*), New Delhi, 1955, 263, 58 pp. (*Rauwolfias:* pp. 227-231; 256-263).

CHOPRA, R. N. et al. Poisonous plants of India, Vol. I. Manager of Publns., Delhi, 1949. (*R. serp.*, pp. 48, 61, 642, 661-64).

CHOPRA, R. N. et al. Utilization of Indian medicinal and allied plants. Review. *Sci. & Cult.*, 1958, **24**, 59-64.

COOKE, T. Flora of the Presidency of Bombay. London, 1903. (*R. serp.*, Vol II, pp. 126-28).

COURT, W.E. et al. Distribution of alkaloids in *Rauwolfia caffra*, Sond. and related species. *J. Pharm.* (Lond.), June 1958, **10**(6), 380-383.

COURT, W. E. et al. Structure of the roots and stem of *Rauwolfia caffra*, Sond. *J. Pharm.* (Lond.), 1957, **9**, 237-250.

CRAIB, W. G, Florae Siamensis Enumeratio. Siam Society, Bangkok. (*R. serp.*, Vol. II, pt. 5, p. 428).

DATTA, S. C. Investigation of some species of *Rauwolfia* for finding a new source of reserpine. *Indian J. Pharm.*, 1956, **18**, 181-84.

DATTA, S. C. Pharmacognostic studies on commercial varieties of roots of *Rauwolfia*. *Indian J. Pharm.*, 1949, **11** (4), 105-17; *Proc. 36th Ind. Sci. Congr.*, 1949, Abst. pt. 3 : p. 512.

DATTA, S. C. Pharmacognostic studies in the leaves of a few species of *Rauwolfia*. Determination of palisade ratio and stomatal index value. *Indian J. Pharm.*, 1944, **6** (4), 77-80, 82.

DATTA, S. C. and MUKERJEE, B. Pharmacognosy of Indian root and rhizome drugs. *Pharm. Lab. Bull. No. 1*, New Delhi, 1950. (*R. serp.*, pp. 83-84).

DE KRUIF, P. *Rauwolfia* against high blood-pressure. *Readers Digest*, Aug. 1954, **65**, 31-6.

DEY, K.L. Indigenous drugs of India. Short descriptive notices of the principal medical products met with in British India. Assisted by Wm. Mair, 2nd ed. Calcutta, 1896. (*R. serp.*, p. 267).

DILLEMANN, G. and PARIS, R. Two *Rauwolfias* of Laos (in French). *C.R. Acad. Sci.* (Paris), 25 Feb. 1957, **244**(9), 1254-1256.

DILLEMANN, G. et al. Essai des *Rauwolfia*. V. *R. logeacuminata* de Wild. et Th. Dur. et. *R. Obscur* K. Schumann. *Ann. Pharm. franc*, 1958, **16** (718), 504-10 (anatomy and morphology).

DOURLEY, J. *Rauwolfia serpentina*. *Prof. Gard.*, Apr. 1958, **10**(4), 74,77.

DRURY, H. The useful plants of India. Allen, London, 1873. (*R. serp.*, p.320).

DUBOIS, L. *Rauwolfia vomitoria* Afzel. *Bull. agric. Congo belge.*, 1955, **46**(3), 567-95.

DUTHIE, J.F. Flora of the Upper Gangetic plain, Calcutta, 1903. (*R. serp.*, Vol. II, p. 32).

DUTT, U.C. Materia medica of the Hindus with a glossary of Indian plants. rev. ed. Calcutta, 1922. (*R. serp.*, p. 317).

DYMOCK, W. Vegetable materia medica of Western India. 2nd ed. Bombay, 1885. (*R. serp*, p.505).

EISENBERG, W.V. and SCHULZE, A.E. The differentiation of roots of *Rauwolfia serpentina* from roots of other *Rauwolfia* species. I. Microscopic methods. *J. Ass. off. agric. Chem.*, 15 Nov. 1955, **38**, 857-865.

ESDORN, I. *Rauwolfia*—a modern pharmaceutical plant (in German). *Umschau*, 1956, **56**(9), 270-272.

ESDORN, I. and SCHMITZ, H. Pharmaceutically significant *Rauwolfia* species (in German). *Pharmzie*, 1956, **11**(1), 50-63.

EVANS, W.C. Structure of the root, rootstock and stem-base of *R. vomitoria*, Afz. *J. Pharm.* (London), 1956, **8**(2), 120-33.

FERREYRA, R. The *Rauwolfias* in Peru (in Spanish). *Bolivian Trimestral exp. Agropecuaria*, (Peru), 1955, **4**(4), 13-15.

FERREYRA, R. The *Rauwolfias* of Peru (in Spanish). *Tech. Agropecuaria*, First Quart., 1956, **2**(5), 8-9, 12.

FERREYRA, R. *Rauwolfia* from Peru (in Spanish). *Lima Estac. Expt. Agr. de La Molina*, Oct. 1955, **29**(339), 1-4.

FEUELL, A.J. The genus *Rauwolfia*: Some aspects of its botany, chemistry and medical uses. With a note on Leonard Rauwolf and an 18th century account of the uses of *Rauwolfia*. *Colonial Plant & Animal Products*, 1955, **5** (1), 1-33.

GAMBLE, J.S. Flora of the Presidency of Madras. London, 1935. (*R. serp.*, p. 806).

GILLOT, J. Some observations on the harvest of the roots of *R. vomitoria*, Afz. from fallow land (in French). *Bull. Inform. Inst. Nat. e Agron. Congo Belge*, 1955, **4**(2), 83-88.

GITHENS, THOMAS S. Drug plants of Africa. African Handbook: University of Pennsylvania Press, The University Museum, Philadelphia, 1949. (*Rauwolfia*, pp. 34, 102).

GRESHOFF, M. Schetsen van Nuttige Indische Planten. Amsterdam, 1894-95. (*R. serp.* sketch of plant).

GROH, G. W. Witch doctors and your health. *Cosmopolitan*, Oct. 1955, **139**, 116-19. (*R. serpentina*).

GUPTA, B. Adulteration of the root of *Rauvolfia serpentina*, Benth. *Indian J. Pharm.*, 1956, **18**, 179-81; (also "Proc. Symp. on *Rauwolfia*", pp. 45-47).

GUPTA, B. Anatomy of *Rauwolfia serpentina*, Benth. (Lett.). *Sci. & Cult.*, 1957, **23**, 200-201.

HAINES, H.H. Botany of Bihar and Orissa. London, 1925. (*R. serp.*, Vol. IV, p.538-39).

HEYNE, K. De Nuttige Planten van Nederlandsch Indie. Buitenzorg Deptt. van Landbouw, Nijverheid en Handel. 2nd ed. 1927. (*R. serp.*, Vol.2, p. 1286).

HOOKER, J.D. The flora of British India. London, Reeve. (*R. serp.*, Vol. III, p.632).

INDIA GOVT. Indian Pharmaceutical List, 1946. Calcutta, Govt. of India Press. (*R. serp.*, pp. 109-10).

INDIA GOVT. Indian pharmacopoeia (Ministry of Health). New Delhi, Manager of Publications, 1956, 1001 pp. (*Rauwolfia:* 524-525; Liquid extract of *Rauwolfia:* 226-227; Dry extract of *Rauwolfia*: 227-228; Tincture of *Rauwolfia:* 693).

INDIA (REPUBLIC). Forest Products Research in India, 1948-1953. New Delhi, Manager of Publications.

Indian Council of Agricultural Research. Annual Report for 1954-55. Delhi, Manager of Publns., 1957. 175 pp. (incl. trials of *R. serpentina*).

ISWARIAH, V. *Rauwolfia serpentina. Curr. Sci.*, 1954, **23**, 253.

KALYANASUNDARAM, S. and JAYALAKSHMI, A. P. Propagation of *Rauwolfia serpentina*, Benth. by split stumps. *Madras agric. J.*, Mar. 1957, **44**(3), 107.

KANJILAL, U.N. and DAS, A. Flora of Assam, (*R. serpentina*, Vol. III, pp. 250-52).

KARIMULLAH. Blood pressure and *Rauwolfia serpentina. Pakist. J. Sci.*, 1954, **6**(4), 226-227.

KAUL, K. N. Observations on the natural occurrence and cultural methods of *Rauwolfia serpentina*, Benth. *Indian J. Pharm.*, 1956, **18**, 127-31; (also in "Symposium on *Rauwolfia:* Abstracts of Papers," Lucknow. 1955, p.3).

KERSTEIN, G. History of *Rauwolfia. Planta Med.*, 15 Dec. 1957, **5**(56), 131-134.

KHAN, ABDUL HAMID. Preliminary cultivation of *Rauwolfia serpentina* in West Pakistan. *Pakist. J. Forestry*, Jan. 1958, **8**(1), 128-129.

KHAN, ABDUL HAMID and HUSSAIN, S. MURTAZA. Some observations on *Rauwolfia serpentina*, Benth. its occurrence and scope of cultivation in East Pakistan. *Pakist. J. Forestry*, 1955, **5**(4),230-40.

KHORY, R.N. and KATRAK, K. N. Materia medica of India and their therapeutics. Bombay, Times of India, 1903. (*R. serp.*, p. 389).

KIRTIKAR, K. R. et al. Indian medicinal plants. 2nd ed. Allahabad, 1935. (*R. serp.*, Vol. II, pp. 1550-51; pl. 602 A).

KURZ, S. Forest flora of British Burma. Calcutta, 1877. (*R. serp.*, Vol. II, p. 170-1).

LEGRE, L. La Botanique en Provence an XVIe Siecle; Leonard Rauwolf - Jacques - Raynaudet. Marseilles, Aubertin & Rolle. 1900 (Biographical monograph which also includes a commentary on the various plants collected by Rauwolf during his life time).

LEMLI, J. The botany of *Rauwolfia* with special reference to species important in medicine (in German). *Planta Med.*, 15 Dec. 1957, **5**(56), 135-144.

LEWIN, L. Arrow-poisons (in German). Leipzig, 1923. (use of *Rauwolfia serpentina* to poison humans and animals).

LEWIN, L. Poisons and poisoning (in German). Berlin, 1929. (*Rauwolfia serpentina* as fish poison, p. 777).

LI, CH'ENG-KU et al. Pharmacognostical study of Chinese *Rauwolfia*. 1. Root and rhizome. *Acta. pharm. sin.*, 1957, **5**, 293.

LINDLEY, J. Flora Medica. London, Longmann, Orme, Brown, Green, 1838. (*R. serp.* as an alexipharmic p. 531.)

MALIK, MOHAMMAD ABDUL BARI. Medicinal plants of East Pakistan. *Medicus* (Karachi), 1955, **10**(6), 216-24. (*R. serp.*, p. 222).

MEENAKSHI, S. This wonder drug: *Rauwolfia. Indian Fmg.*, 1958, **8**(2), 16,40.

MERCK INDEX. Darmstadt, E. Merck & Co. (*Rauwolfia alkaloids*, 1940, p. 402; 1953, pp. 308-310; 1954-55. pp. 220-228).

MERRILL, E.D. An interpretation of Rumphius's Herbarium Amboinense. Manila, Bureau of Printing, 1917. (In discussing the identity of *Radix mustelae* of Rumphius, he points out that Linnaeus in 1759 had correctly classified this as *Ophioxylon serpentinum- R. serpentina*).

MEZEY, K. and URIBE, B. *Rauwolfia hirsuta;* Colombian medicinal plant. *Arch. int. Pharmacodyn.*, 1 July 1951, **98**, 273-283.

MHASKAR, K.S. and CAIUS, J.F. Indian plant remedies. (Indian Medical Research Memoir No. 19). Calcutta, 1931. (*R. serpentina*, p. 68: failed to find any anti-poisonous effect on snake-bite).

MILOSEVIC, M.P. *Rauwolfia serpentina. Archiv farm.*, 1955, **5**, 228-235.

MOHANTY, N. N. Target spot of *Rauwolfia serpentina*, Benth. (Lett.). *Sci. & Cult.*, 1958, **23**, 608-609.

MOHANTY N.N. and ADDY, S.K. Cereospora leaf-spot of *Rauwolfia serpentina*, Benth. *Curr. Sci.*, Sept. 1957, **26**(9), 288-290.

MONACHINO, J. *Rauwolfia serpentina*—its history, botany and medical use. *Econ. Bot.*, 1954, **8**(4), 349-65.

MONACHINO, J. *Rauwolfia serpentina. Gard. J. N.Y. bot. Gard.*, Sept. 1954, **4**, 152-3.

MONSEUR, X. The cultivation of *Rauwolfia* (in French). *Bull. agric. Congo belge*, 1955, **46**(5), 1277-1279. (Rev. in the *Indian For.*, 1955, **81**(4), 258).

MUKERJI, B. Central Drug Research Institute. *March of India* (New Delhi), 1955, **7**(12), 34-37. (incl. reference to work on *Rauwolfia* species).

MUKERJI, B. Indian Pharmaceutical Codex, Vol. 1: Indigenous Drugs. New Delhi, C.S.I.R., 1954, 431 pp. (*R. serp.*, pp. 217-21).

MUKERJI, B. New drugs for the mentally ill. (President's page). *Indian J. Pharm.*, 1955, **17**(9), 180-81.

MUKERJI, B. *Rauwolfia*—India's wonder drug. (President's page). *Indian Pharm.*, 1954, try **16**(7), 147-48.

MUKERJI, B. Indian *Rauwolfias* and their place in therapy. *J. sci. industr. Res.*, 1955, **14A**(7), Supp. 33 pp. (Botany, Pharmacognosy, Chemis- and therapeutic uses).

NADKARNI, K. M. Indian Materia Medica. 3rd rev. ed., enlarged by A. K. Nadkarni. Bombay, Popular Book Depot., 1954. (*R. serp.*, Vol. I, pp. 1050-53).

NAIR, K.N.R. *Rauwolfia serpentina*, Benth.—its importance and cultivation. *Indian For.*, 1955, **81**(3), 168-71.

NAYAR, S.L. Experimental propagation and culture of *Rauwolfia serpentina*, Benth., by seeds. *Indian J. Pharm.*, 1956, **18**, 125-26. (also in "Symposium on *Rauvolfia:* Abstracts of Papers" Lucknow, 1955, pp. 1-2).

NIERSTRASZ, V.E. *Rauwolfia* as heart poison (in Dutch). Thesis Dr. Med., Utrecht univ., 1907.

NOPPEN, C.J. VAN. *Rauwolfia serpentina* (in Dutch). *Herba*, Mar.-Apr. 1954, **13**, 13-23; May-June, 1954, p. 54.

NOPPEN, C.J. VAN. *Rauwolfia serpentina*. Constituents and their pharmacological action. *Pharm. Tijdschr. Belg.*, 1954, **31**(9), 209-42 (a botanical-pharmacological study).

Note on nomenclature. *Indian J. Pharm.*, 1956, **18**(7), 317-18; also letter to the editor: *Rauwolfia* or *Rauvolfia*, by D.R. Mehta, *ibid.*, 1956, **18**(7), 326.

O'SHAUGHNESSY, W. B. Bengal dispensatory. Calcutta, Thacker, Spink, 1841. (*R. serp.*, p. 447).

PARIS, R. On an African *Apocynaceae* the *R. vomitoria* Afz. (in French). *Ann. pharm. franc.*, 1943, **1**, 138-42.

PARIS, R. and DAZA, R.M. An Apocynacea of Columbia: the pinique-pinique (*R. heterophylla*). *Bull. Sci. Pharmacol.*, 1941, **48**, 146-52 (chem. & pharmacology).

PENICK, S.B. & Co. *Rauwolfia* and alkaloids, a bibliography; chemistry, pharmacology, pharmacognosy, therapeutic uses. New York, 1956. 50 pp.

PERROT, E. and Vogt, E. Poisons de Fleches et poisons de'Epreuve. Paris, Vigot Freres, 1913. (*R. serp.*, p. 224).

PHILLIPS, E.P. *Rauwolfia caffra*, Sond, considered to include *R. natalensis* Sond. *J. S. Afr. Bot.*, 1946, **12**, 111.

PRAIN, DAVID. Bengal plants. Calcutta, 1903. (*R. serp.*, Vol. II, pp. 670-71).

RAMA RAO, R.S.M. Flowering plants of Travancore. Trivandrum, Govt. press, 1914. (*R. serp.*, p. 251).

Rauwolfia and high blood pressure. *Discovery*, 1954, **15**(8), 310.

RAYMOND, W.D. *Rauwolfia caffra*. *Tanganyka Notes*, 1936, No. 2, 53.

RICHARDS, RW. *Rauwolfia* B.P.C., renewed interest in an old India remedy. *Mfg. Chem.*, 1954, **25**(6), 253-255.

RIEPPEL, F.W. Leonhard Rauwolf (in German). *Dtsch. Med. Wschr.*, 22 Apr. 1955, **80**, 653-655.

RIO IBANEZ, J. DEL and RUIZ, GIJON J. Studies on *Rauwolfia serpentina*, Benth. and its alkaloids (in Spanish). *Farmacognosia*, **15**, Nos. 35-36, 1955, 97-201 (incl. botany, pharmacognosy, chemistry, etc.).

ROXBURGH, W. Flora Indica. 2nd ed. Serampore, Thacker & Parbury, Allen. 1832. (*R. serpentina*, Vol.I, p. 694).

RUMPHIUS, G.E. Herbarii Amboinensis Auctuarium, Amsterdam, 1755 (*R. serpentina*, C. 37, p. 29: Among older writers gives perhaps one of the fullest accounts of the uses of *R. serp.*, which he describes under the name of *Radix mustleae*).

SANTAPAU, H. Correct spelling of *Rauwolfia*, with a note on Rauwolf. *Sci. & Cult.*, 1956, **22**(5), 285.

SANTAPAU, H. Botanical aspects of *R. serpentina*, Benth. *Indian J. Pharm.*, 1956, **18**, 117-25; (also in "Symposium on *Rauwolfia:* Abstracts of Papers," Lucknow, 1955, p. 1).

SANYAL, D. Vegetable drugs of India. Calcutta, 1924. (*R. serp.*, pp. 329-30).

SATHYANARAYANA RAO, A. A revision of *Rauwolfia* with particular reference to the American species. *Ann. Mo. bot. Gdn.*, Sept. 1956 **43**(3), 253-355; (also *Dissert. Abst.*, 1957, **77**(1), 25).

SCHINDLER, H. Pharmacognosy of *Rauwolfia serpentina*, Benth. & Hook. (in German). *Dtsch. Apothztg.*, 29 July 1954, **94**, 689-691.

SEN GUPTA, N.N. Ayurvedic system of medicine, Vol. III: Indian indigenous drugs and plants. Calcutta, Mukherjee, 1926, 886 pp. (*R. serp.*, p. 715).

SHERFF. Hawaiin species of *Rauwolfia*. Field Museum of Natural History, Chicago, Publn. No. 613.

SIDDIQUI, S. The story of *Rauwolfia*. *Hamdard Med. Digest*, Feb. 1958, **1**(11), 1-6, 67; Dawn, Indep. Day Suppl., 14 Aug. 1957, p. III.

SOBTI, S.N. et al. Propagation of *Rauwolfia serpentina* in Jammu and Kashmir. *J. sci. industr. Res.*, June 1957, **16A**(6), 268-269.

SOMERS, K. Notes on *Rauwolfia* and ancient medical writings of India. *Med. Hist.* (Lond.), Apr. 1958, **2**(2), 87-91.

SRIVASTAVA, G.S. and CHANDRA, V. Tricotyly in *Rauvolfia serpentina*, Benth. (Lett.). *Sci. & Cult.*, 1958, **24**, 87-88.

STEENIS-KRUSEMAN, M.J. VAN. Select Indonesian medicinal plants. (Org. for Sci. Research in Indonesia, Bull. No. 18). Djakarta, 1953. (*R. serp.*, p. 13).

STEINEGGER, E. *Rauwolfia*, the re-discovery of an old healing plant (in German). *Bull. Galenica*, 1954, **17**, 50-61. (Review of various *Rauwolfia* spp.; descriptive catalogue of 15 proprietary products is appended).

STRACHEY, RICHARD. Catalogue of the plants of Kumaon, and of the adjacent portions of Garhwal and Tibet. Revised and supplemented by J.F. Duthie. London, Lovell Reeve, 1906, vii, 269 pp. (*R. serpentina*, p. 110).

SUBRAMANIAN, S. S. A note on "The Indian Pharmacopoeial List", *Indian J. Pharm.*, 1948, **10**(1), 4-5. (*Rauwolfia*, p.5).

Supply of therapeutic substances, their control, and conservation of precious indigenous drugs e.g. *R. serpentina*. (Editorial). *Calcutta med. J.*, 1954, **51**(11), 378-380.

Symposium on *Rauwolfia* (under the auspices of the Pharmaceuticals and Drugs Research Committee, C.S.I.R., India). *Curr. Sci.*, 1955, **24**(6), 215; *J. Instn. Chem., India*, Oct. 1955, **27**(4), 285-286; *J. sci. industr. Res.*, 1956, **15A**(1), 40; Complete proceedings in *Indian J. Pharm.* 1956, **18**(4-7); Reprinted by the Indian Pharmaceutical Asson., Bombay, 1958. Rs. 5/- (Abstracts of papers, issued separately by the Central Drugs Research Laboratory, Lucknow, 1955, 38 pp.).

TREASE, G.E. and EVANS, W.C. *Rauwolfia serpentina* and other species. *Pharm. J.*, May 1, 1954, **172**, 351-53 (pharmacognosy, etc.).

TRIMEN, H. Handbook to the flora of Ceylon. London, Dulau, 1895. (*R. serp.*, Vol. III, p. 126).

VARADARAJAN, P.D. *Alterneria tenius* on *Rauwolfia serpentina* (Lett.). *Sci. & Cult.*, 1958, **24**, 231-232.

VARADARAJAN, P.D. Blight and die-back disease of *Rauwolfia serpentina*. *J. biol. Sci.* (Bombay), 1958, **1**, 1-4.

VARADARAJAN P.D. Stem rot of *Rauwolfia serpentina*. (Lett.). *Curr. Sci.*, 1958, **27**, 448-449.

WALLIS, T.E. and ROHATGI, S. Pharmacognosy of *Rauwolfia*. *J. Pharm. & Pharmacol.*, 1932, **69**, 334.

WAN, A.S.C. Pharmacognosy of *R. perakensis*. *J. Pharm.* (London), 1955, **7**(3), 167-76.

WARING, E.J. Pharmacopoeia of India. London, Allen, 1868, 502 pp. (*R. serp.*, p. 139).

WATT, GEORGE. Dictionary of the economic products of India. London, Allen, 1892. (*R. serpentina*, Vol. VI, pt. 1, pp. 398–399).

WATT, J.M. and BREYER-BRANDWIJK, M.G. Medicinal and posionous plants of South Africa. Edinburgh, Livingstone, 1932, (*R. natalensis* p. 144: use as febrifuge in malaria and other fevers).

WEISS, R.F. The present status of the *Rauwolfia* problem (in German). *Hippokrates* (Stuttgart), 31 May 1958, **29**(10), 315-319.

WIGHT, R. Icones Plantarum Indiae Orientalis. Madras, 1843-45 (*R. serp.* drawing of plant, Vol. III, t. 849, Plate 602A).

WOODSON, R.E. et al. *Rauwolfia*: botany, pharmacognosy, chemistry and pharmacology. 1st ed. Boston, Little, Brown, 1957. *xii*, 149 pp.

YOUNGKEN, H. W. Malabar *Rauwolfia*, *R. micrantha*. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1954, **43**, 141-3. (Differences are described between microscopic structure of the roots of *R. micrantha*, *canescens*, *serpentina*, etc.).

YOUNGKEN, H.W. A note on *Rauwolfia serpentina*. *Amer. J. Pharm.*, 1953, **125**(6), 186-89. (Description of the root).

YOUNGKEN, H. W. Observations on *Rauwolfia combodiana*. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1956, **45**(11), 721-4.

YOUNGKEN, H. W. Pharmaceutical botany. 7th ed. Philadelphia, Blackiston, 1951. (*Rauwolfia*, p. 657)

YOUNGKEN, H.W. A pharmacognostical study of *Rauwolfia*. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1954, **43**(2), 70-78.

YOUNGKEN, H.W. A pharmacognostical study of the root of *Rauwolfia heterophylla* Poem et Schult. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1955, **44**(12), 723-727.

II. CHEMISTRY

ACHELIS, J. D. and KRONEBERG, G. New alkaloid of *R. serpentina* (in German). *Naturwissenschaften*, 1953, **40**, 625.

ALAUDDIN, MOHAMMAD. Analytical studies in the root of *Rauwolfia serpentina*, Benth., and improved method for their alkaloidal assay. *Pharm. Pakist.*, 1957, **2**, 321-24.

Alkaloid studies; isolation of reserpine and narcotine from *Rauwolfia heterophylla*, Roem & Schult. *J. Amer. chem. Soc.*, 1953, **75**, 5446-5447.

ANET, F.A.L. et al. Ajmaline. Pt. I. *J. chem. Soc.*, 1954, 1242-60.

Antileukemic compounds; reserpine and related compounds, *Chem. Engng. News*, 1957, **35**, 24.

ARORA, R.B and BHARGAVA, V.N. An assay procedure for *Rauwolfia serpentina* alkaloid. *Sine-* reserpine. *Indian J. Pharm.*, 1956, **18**, 243-47.

ARTHUR, H. R. 8-Yohimbine from the bark of *R. verticillata*. *Chem. & Ind.*, 1956, 85.

BADER, F. and SCHWARZ, H. The constitution of serpentine. *Helv. chim. acta*, 1952, **35**, 1594-1598.

BADER, F.E. et al. *Rauwolfia* alkaloids. IX. Isolation of yohimbine from *Rauwolfia serpentina*. *J. Amer. chem. Soc.*, 1954, **76**, 1695.

BADER, F.E. et al. *Rauwolfia* alkaloids. XI. Isolation of an isomer of yohimbine. *Experientia*, 1954, **10**, 298.

BADER, F.E. et al. *Rauwolfia* alkaloids. XVII. 3-epi-α- yohimbine. *J. Amer. chem. Soc.*, 1955, **77**, 3547-50.

BAJPAI, M.P. and SHARMA, V.N. Studies in the alkaloids of *Rauwolfia serpentina*, Benth. *Indian J. Pharm.*, 1956, **18** 199.

BAKSHI, V.M. *Serpentina* alkaloid. *Indian J. Pharm.*, 1950, **12**, 172. (A new method of micro-determination of the alkaloids of *R. serp.*).

BANERJEE, R.P. and CHATTERJEE, M.L. *Rauwolfia* alkaloids. Some observations on the analytical approach. *Indian J. Pharm.*, 1956, **18**, 240-43.

BANERJEE, R.P. and CHATTERJEE, M.L. *Rauwolfia* alkaloids; basis for a fluorometric method of estimation. *Bull. Calcutta Sch. trop. Med.*, 1955, **3**, 166-67.

BANERJEE, R.P. and HAUSLER, H.F. Method for separation of soluble *Rauwolfia* alkaloids (in German). *Arch. exp. Path. Pharmak.*, 1956, **228** (1-2), 172.

BANERJEE, R.P. et al. Fractionation o' *Rauwolfia* alkaloids by counter current distribution. *J. Pharm.* (London), 1957, **9**, 120-127.

BANES, D. Collaborative study of the analysis of *Rauwolfia serpentina*. *Drug Standards*, 1957, **25**, 61-63.

BANES, D. The identification and determination of reserpine in tablets. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 408-11.

BANES, D. *Rauwolfia serpentina*. *J. Ass. off. agric. Chem.* (Wash.), 1957, **40**, 798-800.

BANES, D. Report on reserpine and related alkaloids. *J. Ass. off. agric. Chem.* (Wash.), 1956, **39**, 620-623.

BANES, D. Reserpine. *J. Ass. off. agric. Chem.* (Wash.), 1957, **40**, 790-798.

BANES, D. A simplified nitrite procedure for the determination of reserpine. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1957, **46**, 601-603.

BANES, D. and CAROL, J. Differentiation of roots of *R. serpentina* from roots of other *Rauwolfia* species. II. Chemical methods. *J. Ass. off. agric. Chem.* (Wash.), 1955, **38**, 866-70.

BANES, D. et al. The assay of *Rauwolfia serpentina* preparations. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1956, **45**, 708-9.

BANES, D. et al. Chromatographic analysis of reserpine preparatons. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 640-44.

BANES, D. et al. The oxidative degradation of reserpine preparations. *J. Amer. pharm Ass. (Sci. Ed.)*, 1956, **45**, 710-11.

BANES, D. et al. Reserpine, rescinnamine, and deserpidine content of *Rauwolfia* roots. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1958, **47**, 625.

BARTLET, W.F. and HAMLOW, E.E. The determination of reserpine by chromatographic separation from pharmaceutical products. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 660-2.

BATTINK. *Ned. Tijdschr. Pharm. Chem. Toxic.*, 1881, **21**, 1 (obtained a crystalline substance from the root of *R. serpentina*, but could not recognise it).

BEAN, J.W. Reserpine and reaction to O_2 at high pressure. *Fed. Proc.*, 1956, **15**, 11-12 (abstract).

BENTLEY, K.W. The alkaloids: The chemistry of the natural products. Vol. I. New York, London, 1957, 245 pp. (includes reference to *Rauwolfia*).

BHATTACHARJI, S. et al. Isolation of sarpagine from *R. canescens* L. *J. sci. industr. Res.*, 1955, **14B**, 310.

BHATTACHARJI, S. et al. C_{22}-raunescine renamed canembine. (Lett.). *J. sci. industr. Res.*, 1957, **16B**, 97 (alkaloid of *R. canescens*).

BHATTACHARJI, S. et al. Raunescine, a subsidiary alkaloid from *Rauwolfia canescens*, Linn. *Indian J. Pharm.*, 1956, **18**, 188-190; (also in *J. sci. industr. Res.*, 1956, **15B**, 506-509).

BODENDORF, K. and EDER, H. Raupine, a new alkaloid from *R. serpentina*. *Naturwissenschaften*, 1953, **40**, 342; *Chem. Ber.*, 1954, **87**, 818-19.

BONINO, R. CD' ALESSIO DE CARNEVALE. Comparative analytical study of reserpine and yohimbine. *Rev. Asoc. bioquim. argent.*, 1956, **21**, 207-214.

BOOTH, ROGER E. Determination of reserpine in pharmaceutical preparations. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 568-70.

BOSCOTT, R.J. and KAR, A.B. Paper-chromatographic and biological properties of reserpine and related compounds. *Nature*, 1955, **176**, 1077-8.

BOSE, A.K. et al. The absolute configuration of yohimbine alkaloids. *Indian J. Pharm.*, 1956, **18**, 185-88; also in "Symposium on *Rauwolfia*: Abstracts of Papers," Lucknow, 1955.

BOSE, B. A new method of assay of *Rauwolfia serpentina*. *J. Instn. Chem.* (India), 1957, **29**, 166.

BOSE, S. et al. The alkaloids of *R. beddomei*, Hook. F.I. *J. Indian chem. Soc.*, 1956, **33**, 379-84.

BOSE, S. Isolation of γ-sitosterol from the resin of *R. serpentina*, Benth. *Sci. & Cult.*, 1955, **21**, 43.

BOSE, S. On the constitution of serpinine, a minor alkaloid of *R. serpentina*, Benth. *J. Indian chem. Soc.*, 1956, **33**, 374-78.

BOSE, S. Rauwolfinine; a new alkaloid of *R. serpentina*, Benth. Pt. I. *J. Indian. chem. Soc.*, 1954, **31**, 47-49.

BOSE, S. Rauwolfinine; a new alkaloid of *R. serpentina*, Benth. Pt. II. Studies on the ultraviolet and infra-red absorption spectra. *J. Indian chem. Soc.*, 1954, **31**, 311-15.

BOSE, S. Rauwolfinine; a new alkaloid of *R. serpentina*, Benth. Pt. III. Studies on the degradation of rauwolfinine. *J. Indian chem. Soc.*, 1954, **31**, 691-94.

BOSE, S. Rauwolfinine; a new alkaloid of *Rauwolfia serpentina*, Benth. IV. Studies on the constitution of rauwolfinine. *J. Indian chem. Soc.*, 1958, **35**, 72-74.

BOSE, S. Rauwolfine; a new alkaloid of the root of *R. serpentina*, Benth. *Sci. & Cult.*, 1952, **18**, 98.

BOSE, S. Serpinine, a minor alkaloid of *R. serpentina*, Benth. *Naturwissenschaften*, 1955, **42**, 71-72.

BRUNDO, O.G. and WARREN, E.L. *Rauwolfia* alkaloids. I. Reserpine and ajmaline from *R. natalensis*, Sond. *J. chem. Soc.*, 1956, 215-17.

CAROL, J. et al. The chemical evaluation of *R. serpentina* preparations. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1956, **45**, 200-3.

CAVAZZUTI, F. and CRISTINI, M. Chemical researches on new combinations of hypotensive drugs: *Rauwolfia serpentina* - chlorpromazine, (in Italian). *Minerva med.* (Torino), 1957, **48**, 845-848.

CERELETTI, A. et al. Canescine, an alkaloid from *R. canescens* with the same effect as reserpine. *Experientia*, 1955, **11**, 98-99.

CHATTERJI, Mrs. ASIMA (*nee* MOOKERJEE). Alkaloids of *Rauwolfia canescens*, Linn. Pt. IV. On the constituent of rauwolscine. *J. Indian chem. Soc.*, 1946, **23**, 6-8.

CHATTERJEE, ASIMA. Alkaloids of *R. canescens* (in "Symposium on *Rauvolfia:* Abstracts of Papers," Lucknow, 1955). *Indian J. Pharm.*, 1956, **18**, 232-239.

CHATTERJEE, ASIMA. Chemistry of the alkaloids of *Rauvolfia canescens*, Linn. *Indian J. Pharm.*, 1956, **18**, 232-39.

CHATTERJEE, ASIMA. On the alkaloid of *R. canescens*. Pt. V. *J. Indian chem. Soc.*, 1951, **28**, 29-33.

CHATTERJEE, ASIMA. *Rauwolfia* alkaloids. *Fortschr. Chem. org. Naturst.*, 1953, **10**, 390-422.

CHATTERJEE, ASIMA and BOSE, S. Chemistry and pharmacology of ajmaline, rauwolfinine and serpentine. I. Chemistry. *Bull. nat. Inst. Sci. India*, 1953, No. 4, 32-34.

CHATTERJEE, ASIMA and BOSE, S. Constitution of ajmaline. *Experientia*, 1953, **9**, 245-6.

CHATTERJEE, ASIMA, and BOSE, S. The constitution of ajmaline. *J. Indian chem. Soc.*, 1954, **31**, 19-24.

CHATTERJEE, ASIMA and BOSE, S. Constitution and stereochemistry of serpine. *Sci. & Cult.*, 1955, **21**, 110-11.

CHATTERJEE, ASIMA and BOSE, S. Isolation of serpine, a new isomer of yohimbine from the root of *R. serpentina*, Benth. *Sci. & Cult.*, 1954, **19**, 512-13.

CHATTERJEE, ASIMA and BOSE, S. A new alkaloid from the root of *R. serpentina*. *Sci. & Cult.*, 1951, **17**, 139. (Rauwolfinine).

CHATTERJEE, ASIMA and BOSE, S. On the constitution of ajmaline, the alkaloid of *R. serpentina*, Benth. *Sci. & Cult.*, 1955, **20**, 606-609; *Proc. Indian Sci. Congr.*, 1955, **42**, 137 (abstract).

CHATTERJEE, ASIMA and BOSE, S. Serpine—a new isomeride of yohimbine isolated from *R. serpentina*, Benth. *Experientia*, 1954, **10**, 246-7.

CHATTERJEE, ASIMA and PAKRASHI, S. The alkaloids of *R. canescens*, Linn. Pts. VI-VIII. *J. Indian chem. Soc.*, 1954, **31**, 25-33.

CHATTERJEE, ASIMA and PAKRASHI, S. On the constitution of rauwolscine, the alkaloid of *R. canescens*. *Sci. & Cult.*, 1953, **19**, 109-11.

CHATTERJEE, ASIMA and PAKRASHI, S. On the stereochemistry of rauwolscine, the alkaloid of *Rauwolfia canescens*. *Naturwissenschaften*, 1954, **41**, 215.

CHATTERJEE, ASIMA and PAKRASHI, S. Studies on the steric hindrance to N-acylation of indole-NH group in rauwolscine, the alkaloid of *Rauwolfia canescens*, Linn. *Proc. Ind. Sci. Congr.* 1955, **42**, 136 (abstract).

CHATTERJEE, ASIMA and PAKRASHI, S. Yobrine, the selenium dehydrogenation product of rauwolscine, the alkaloid of *Rauwolfia canescens*. *Sci. & Cult.*, 1953, **18**, 443-445.

CHATTERJEE, ASIMA and TALAPATRA, S. Alkaloids of the roots of *R. densiflora*, Benth. & Hook., *R. perakensis*, King & Gamble, *R. canescens*, Linn. *R. serpentina*, Benth. (Lett.). *J. sci. industr. Res.*, 1955, **14B**, 247-48.

CHATTERJEE, ASIMA and TALAPATRA, S. Alkaloids of the roots of *R. densiflora*, Benth. & Hook., *R. perkensis*, King & Gamble, *R. Canescens*, L., and *R. serpentina*, Benth. *Naturwissenschaften*, 1955, **42**, 182.

CHATTERJEE, ASIMA and TALAPATRA, S. Synthesis of reserpine analogue from rauwolscine (trimethyl-galloylrauwolscine) the alkaloid of *R. canescens*, L. *J. sci. industr. Res.*, 1955, **14C**, 237-39.

CHATTERJEE, ASIMA et al. Conformation of rauwolscine, alloyohimbine and their congeners, identification of rauwolscine with α-yohimbine. *Chem. & Ind.*, 1954, 491-92.

CHATTERJEE, ASIMA et al. *Rauwolfia* alkaloids *Fortschr. Chem. org. Naturst.*, 1956, 346-443.

CHATTERJEE, ASIMA et al. Recent developments in the chemistry of *Rauwolfia* alkaloids. *Fortsch. Chem. Org. Naturst.*, 1953, 390-442.

CHEMICAL SOCIETY. Annual report on the progress of chemistry. Reserpine, reserpiline and rescinnamine, Vol. 51, 1954, pp. 257-58. London.

CHEN, G. and BOHNER, B. Method for the biological assay of reserpine and reserpine-like activity. *J. Pharmacol.*, 1957, **119**, 559-565.

CHIARLO, B. and BALDINI, L. Chromatographic determination of reserpine. *Farmaco. ed. prat.* (Pavia), 1957, **12**, 379-381.

CORDOSO, H.T. and VENANCIO, I.A.A. Reserpine in *Rauwolfia ternifolia* (in Portuguese). *Rev. Brasil Biol.*, 1956, **16**, 231-34.

DAS GUPTA, S.J Rauwolscine, the alkaloid of *R. canescens*. (Lett.). *Sci. & Cult.*, 1953, **19**, 44-45.

DAS GUPTA, S.R. et al. Chemistry and pharmacology of amjaline, rauwolfinine and serpentine. *Bull. nat. Inst. Sci. India.*, 1955, No. 4, 35-38; 73-78.

DATTA, S.C. Effect of root diameter on the chemical constituents of *R. serpentina* roots. *Proc. 40th Ind. Sci. Congr.*, 1953, pt. 3; *Abst. Sec. Med. & Vet. Sci.*, p. 63-64.

DATTA, S.C. Effect of root diameter on the variation of alkaloid contents of *Rauwolfia* and *Datura*. *Bull. nat. Inst. Sci. India*, 1955, No. 4, 89-92.

DECHENE, E.B. A fluorometric assay of reserpine. *J. Amer. pharm. Ass.* (*Sci Ed.*), 1955, **44**, 657-60.

DE FELICE, E.A. Adaptation of the methyl orange method for the determination of reserpine. *Experientia*, 1958, **14**, 159-160.

DHAR, M.M. and BHATTACHARJI, S. Method for the estimation of reserpine in samples of *Raur wolfia* alkaloids. *J sci. industr. Res.*, 1955, **14B**,-276-78; (abstract in *Indian J. Pharm.*, 1955, **17**, 192).

DHAR, M.M. et al. Circular paper chromatography of *Rauwolfia* alkaloids. *J. sci. industr. Res.*, 1955, **14B**, 672-73.

DIASSI, P.A. et al. Stereochemistry of reserpine. *J. Amer. chem. Soc.*, 1955, **77**, 2028-29, 4687-88.

DJERASSI, C. and FISHMAN, JACK. Tetraphyllin and tetraphyllicine; two new alkaloids from *Rauwolfia tetraphylla*. *Chem. & Ind.*, 1955, 627-629.

DJERASSI, C. et al. Alkaloid studies: Alkaloids of *Rauwolfia tetraphylla*, the structures of tetraphylline and tetraphyllicine. *J. Amer. chem. Soc.*, 1957, **79**, 1217-1222.

DJERASSI, C. et al. Alkaloid studies: The isolation of reserpine, serpentine and ajmaline from *R. heterophylla*, Roem & Schult. *J. Amer. chem. Soc.*, 1954, **76**, 4463-5.

DJERASSI C. et al. Alkaloid studies. II. Isolation of reserpine and narcotine from *R. heterophylla*, Roem & Schult. *J. Amer. chem. Soc.*, 1953, **75**, 5446-7.

DJERASSI, C. et al. Structure of tetraphyllicine, ajmalidine and rauvomitine. *J. Amer. chem. Soc.*, 1956, **78**, 1259-60.

DORFMAN, L. et al. Constitution of reserpine (in German). *Helv. chim. acta*, 1954, **37**, 59-75.

DORFMAN, L. et al. New information on *Rauwolfia* alkaloids. *Helv. chim. acta*, 1954, **37**, 59, 314.

DORFMAN, L. et al. On the constitution of reserpine from *Rauwolfia serpentina*, Benth. *Experientia*, 1953, **9**, 368-9.

DUTT, A. et al. *Rauwolfia serpentina*, Benth. Comparative chemical investigation of some of the constituents of the drug obtained from different sources and isolation of the active resin. *Indian J. Pharm.*, 1947, **9**, 54-7.

DYMOCK, W. et al. Pharmacographia Indica. A history of the principal drugs of vegetable origin met with in British India. Calcutta & London, 1891. (*R. serp.*, Vol. II, p. 414).

EDER, H. Contents of *R. serpentina* Benth. (in German). *Pharmazie*, 1955, **10**, 236-43.

EVANS, W.C. Tests of *Rauwolfia* and of its derivatives. *Pharm. J.*, 23 Aug. 1958, **181**, 4947.

FERRARA, F.A. Ritalin and *Rauwolfia* and its alkaloids (in Spanish). *Prensa med. argent.*, 1956, **43**, 3538-3541.

FINCH, F.C. et al. Structure of ajmaline. *Chem. & Ind.*, 1955, 653-54.

FORBATH, T.P. (ed.). Liquid extraction commercializes reserpine (practice, process, flowsheet). *Chem. Eng.*, 1957, **64**, 230-33.

FUERLENMIER, A. et al. On the constitution of reserpine. *Experientia*, 1953, **9**, 331-3.

FUHA, TATSUTOYO et al. Incompatibility of *Rauwolfia* alkaloid preparation. *Yukuzaigaku*, 1956, **16**, 23-28.

GANGULY, S.K. and BOSE, A.N. Uniform hypotensive extract of *R. serpentina*, Benth. collected from different sources. *Indian J. Pharm.*, 1956, **18**, 193-95.

GHOSH, B.P. Isolation of serpentine from *Rauvolfia canescens* root. *Indian J. Pharm.*, 1958, **20**, 69-70.

GHOSH, B.P. Isolation of serpine and ajmaline from the root of *Rauvolfia canescens*. *Naturwissenschaften*, 1958, **45**, 365.

GHOSH, S.B. et al. Studies on counter-current distribution. Pt. V. Separation of rauvolscine from yohimbine. *Indian J. Pharm.* 1956, **18**, 196-98.

GOMEZ, L. et al. Isolation of amsoniacfoline, one of the alkaloids from *Rauwolfia amsoniacfolia*. A Dc. *J. Philipp. pharm. Ass.*, 1957, **44**, 127-31.

GORDON, J.A. and CAMPBELL, D.J. Fluorimetric determination of 11-demethoxyreserpine. *Anal. Chem.*, 1957, **29**, 488-490.

GORMAN, M. et al. Alkaloidal studies. XIX. Alkaloids of some Hawaiian *Rauwolfia* species: The structure of sauduricine and its interconversion with ajmaline and ajmalidine. *Tetrahedron*, 1957, **1**, 328.

GOUTAREL, A. et al. Identity of isorauhimbine and 3-epi-x-yohimbine (in French). *Helv. chim. acta*, 1957, **40**, 156-160.

GOUTAREL, R. et al. Raumitorine and seredine (in French). *Bull. Soc. chim. de France*, 1954, 1481.

GRESHOFF, M. Onderzoek naar de Plantens toffen van Nederlandsch-Indie. (Meded Uit's Lands Plantentuin, No. VII (1890), XXV (1898). (*R. serp.* alkaloids, I, pp. 51-55; First chemical studies establishing presence of an alkaloid in roots of the plant; also in *Ber. dtsch. chem. Ges.*, 1890, **23**, 3537).

HAACK, E. et al. Isolation of further (basic) substances from the root of *R. vomitoria*, *Afz. Naturwissenschaften*, 1956, **43**, 328.

HAACK, E. et al. Rauvomitin: a new alkaloid from *R. vomitoria*, Afz. (in German). *Naturwissenschaften*, 1955, **42**, 627.

HAACK, E. et al. *Rauwolfia* alkaloids. IV. Reserpinine and rescinnamine. *Naturwissenschaften*, 1955, **42**, 47.

HAACK, E. et al. Reserpinin, a new alkaloid of *R. serpentina* (in German). *Naturwissenschaften*, 1954, **41**, 214.

HAMIED, K.A. and BAKSHI, V.M. *Rauvolfia serpentina* alkaloids: New method of assay. *Indian J. Pharm.*, 1956, **18**, 190-92.

HARRISON, W.E. et al. Toxicity and chemistry of 11-desmethoxy-reserpine (Raunormine) 3,4,5-trimthoxybenzoic acid ester of methyl-11-desmethoxy reserpate, an alkaloid from *Rauwolfia canescens*. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1955, **44**, 688-693; (abstract in *Indian J. Pharm.*, 1956, **18**, 206).

HAYCOCK, R.P. and MADER, W.J. Reaction of *Rauwolfia* alkaloids, indoles and related compounds to nitrate. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1957, **46**, 744-747.

HAYDEN, A.L. et al. Separation and determinatian of reserpine, deserpidine and rescinnamine by partition column chromatography. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1958, **47**, 157-159.

HENRY, T.A. Plant alkaloids. 4th ed. London, Churchill, 1949. (*R. serp.* alkaloids, pp. 762-65).

HOCHSTEIN, F.A. et al. Alkaloids of *R. heterophylla*. *J. Amer. chem. Soc.*, 1955, **77**, 3551-54.

HOCHSTEIN, F.A. Alkaloids of *R. sellowii* (Aricin, ajmaline, reserpine, and tetra-hydroalstonine). *J. Amer. chem. Soc.*, 1955, **77**, 5744-45.

HOCHSTEIN, F.A. The nature of serpine. *J. org. Chem.*, 1956, **21**, 1516.

HOFMANN, A. Alkaloid of *Rauwolfia*. Pt. VI. β-Yohimbin from roots of *R. canescens*, Linn. *Helv. chim. acta*, 1955, **38**, 536.

HOFMANN, A. Chemistry of the *Rauwolfia* alkaloids with regard to the newest findings. *Planta Med.*, 15 Dec. 1957, **5**(56), 145-155.

HOFMANN, A. Rauhimbin and isorauhimbin, two new alkaloids from *R. serpentina*, Benth. (in German). *Helv. chim acta*, 1954, **37**, 314-20.

HOFMANN, A. *Rauwolfia* alkaloids (in German). *Helv. chim. acta*, 1954, **37**, 849-65.

HOFMANN, A. and FREY, A.A. *Rauwolfia* alkaloid of the ajmaline group (in German). *Helv. chim. acta*, 1957, **40**, 1866-1874.

HOLT, W.L. and COSTELLO, C.H. A preliminary chemical investigation of *Rauwolfia serpentina*. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1954, **43**, 144-148.

HORHAMMER, L. AND RAO, S.B. Determination of alkaloids in *R. serpentina:* A rapid method for determination of the total alkaloids of *R. serpentina* (in German). *Arch. Pharm.* (Berl.), 1954, **287**, 75-6.

HORHAMMER, L. et al. Determination of alkaloids from *R. serpentina*. *Naturwissenschaften*, 1953, **39**, 553.

HOSANSKY, N. and SMITH, E. Raunescine and *iso*-raunescine from *R. canescens*, L. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1955, **44**, 639-640.

HUBER, H.U. Dissertation, University of Basel, 1954.

HUEBNER, C.F. *Rauwolfia* alkaloids. XIII. Derivatives of reserpine. *J. Amer. chem. Soc.*, 1954, **76**, 5792-93.

HUEBNER, C.F. *Rauwolfia* alkaloids. XXIII. Synthesis of (±) reserpine. *Chem. & Ind.*, 1955, 1186.

HUEBNER, C.F. and DICKEL, D.F. *Rauwolfia* alkaloids. XXVI. Stereochemistry at C-17. *Experientia*, 1956, **12**, 250-51.

HUEBNER, C.F. and SCHLITTLER, E. *Rauwolfia* alkaloids. XXIX. The structure of raunescine and isoraunescine, *J. Amer. pharm. Soc.*, 1957, **79**, 250-251.

HUEBNER, C.F. et al. *Rauwolfia* alkaloids. XIV. Derivatives of yohimbe alkaloids. XV. Constitution of reserpic acid, position of substituents in ring E. *J. Amer. chem. Soc.*, 1955, **77**, 469-72; 472-75.

HUEBNER, C.F. et al. *Rauwolfia* alkaloids. XX. 11-methoxy-alloyohimbane from reserpine. *J. Amer. chem. Soc.*, 1955, **77**, 5725-28.

HUEBNER, C.F. et al. *Rauwolfia* alkaloids. XXI. Stereochemistry of reserpine and deserpine. *Experientia*, 1955, **11**, 303-04.

HUEBNER, C.F. et al. *Rauwolfia* alkaloids. XXII: Stereochemistry of reserpine. *J. Amer. chem. Soc.*, 1955, **77**, 4180.

HUEBNER, C.F. et al. *Rauwolfia* alkaloids. XXVII. The conversion of 3-*iso*-reserpine. *Experientia*, 1956, **12**, 249-50.

IAKHONTOV, L.N. Alkaloids of *Rauwolfia* (in Russian). *Usp. Khim.*, 1957, **26**, 239-262.

Improved reserpine analysis. *Chem. & Engng. News*, 1955, **33**, 3166-67.

INDIA, SOCIETY OF BIOLOGICAL CHEMISTS. Annual review of biochemical and allied research in India, Vol. XXVI, 1955, Bangalore, 1956. (Chemistry of Plant Products: *Rauwolfia*, pp. 97, 99-101; also back volumes under same head).

ISHIDATE, M. et al. Isolation of alkaloids from *Rauwolfia* spp. *Pharmaceutical Bull.* (Tokyo), 1955, **3**, 319-20.

JANOT, M.M. Various natural substances (alkaloids and antibiotics); chemotherapeutical research (in French). *Bull. Acad. nat. Med.*, 1956, **140**(3-4), 61-4.

JANOT, M.M. et al. Isolation of serpentine from roots of *R. heterophylla*. *C.R. Acad. Sci.* (Paris), 1954, **238**, 720-2.

JUNG, Z. Reactions with xanthydrol. I. Photometric determination of reserpine (in Czech.). *Cesk. farm.*, 1957, **6**, 299.

JURITZ. Report of the Senior Analyst for the year 1901. Cape Town. (*Rauwolfia caffra*, Sond., p. 58).

KAHALI, B.S. *Rauwolfia serpentina* Benth.—a brief account of its chemistry, pharmacology and therapeutics. *Univ. Rajputana Studies, Med. Sci.*, 1952, 21-36.

KANEKO, HIDEHIKO, Microidentification of *Rauwolfia* alkaloids; paper electro-phoresis and multibuffered paper chromatography. *Yakugaku Zasshi*, 1958, **78**, 512-515.

KANEKO, H. On *Rauwolfia* alkaloids. *Jap. J. Pharm. & Chem.*, **27**, 1955, 218-35.

KAR, A.B. Paper chromatographic and biological properties of reserpine and related compounds. *Nature*, 1955, **176**, 1077-78.

KAR, A.B. and BOSCOTT, R.J. Paper chromatographic and biological properties of reserpine and related compounds. *Indian J. Pharm.*, 1956, **18**, 204-5.

KECK, L.J. Isolation of further components from the roots of *R. canescens*. *Naturwissenschaften*, 1955, **42**, 391.

KIDD, D.A.A. Alkaloids of *Rauwolfia* species: Isolation of rescinnamine from *R. vomitoria* Afz. *Chem. & Ind.*, 1955, 1481.

KIDD, D.A.A. Alkaloids of *Rauwolfia* species: Preliminary studies on *Rauwolfia cambodiana*. *Chem. & Ind.*, 1957, 1013.

KIDD, D.A.A. Alkaloids of *Rauwolfia* species, *Rauwolfia cambodiana*, Pierre. *J. chem. Soc.*, 1958, 2432.

KIDD, D.A.A. et al. Alkaloids of *Rauwolfia* species. II. Estimation of reserpine in *Rauwolfia* samples by means of countercurrent distribution. *J. Pharm.* (Lond.), 1957, **9**, 176-180.

KIESSLING, J. *Rauwolfia serpentina;* review on its chemistry, pharmacology and modern therapy (in German). *Zschr. arztl. Fortbild.*, 1956, **50**, 637-650.

KLOHS, M.W. et al. Alkaloids of *R. canescens* L. II. Isolation and structure of canescine. *J. Amer. chem. Soc.*, 1955, **77**, 4084-98.

KLOHS, M.W. et al. Alkaloids of *R.canescens*, L.III. Pseudo-reserpine. *Chem. & Ind.*, 1956, 187-88.

KLOHS, M.W. et al. Alkaloids of *Rauwolfia canescens*, Linn:the structure of pseudoreserpine. *J. Amer. chem. Soc.*, 1957, **79**, 3763-3766.

KLOHS, M.W. et al. Alkaloids of *R. serpentina*. I. The characterization of reserpine and its hydrolysis products. *J. Amer. chem. Soc.*, 1953, **75**, 4867.

KLOHS, M.W. et al. Alkaloids of *R. serpentina*, Benth. Resetpine. *J. Amer. chem. Soc.*, 1953, **75**, 4867; (independently worked to reach the same conclusions. Muller et al. in *Experientia*, 1952, **8**, 338).

KLOHS, M.W. et al. Reserpiline, alkaloid of *Rauwolfia serpentina*, Benth. *Chem. & Ind.*, 1954, 1264.

KLOHS, M.W. et al.Alkaloids of *Rauwolfia serpentina*, Benth., the isolation of naturally occurring by-tetrahydroserpentina (ajmaline) and a contribution towards its structure. *J. Amer. chem. Soc.*, 1954, **76**, 1332-1334.

KLOHS, M.W. et al.Alkaloids of *Rauwolfia serpentina*, Benth. III. Rescinnamine a new hypotensive and sedative principle from *R. serpentina*. *J. Amer. chem. Soc.*, 1954, **76**, 2843.

KLOHS, M.W. et al. Alkaloids of *R. serpentina*, Benth. IV. Reserpiline. *Chem. & Ind.*, 1954, 1264-65.

KLOHS, M.W. et al. Alkaloids of *Rauwolfia serpentina* Benth. V. Rescinnamine. *J. Amer. chem. Soc.*,1955, **77**, 2241-43.

KLOHS, M.W. et al. Isolation of reserpine from *Rauwolfia canascens*, Linn. *J. Amer. chem. Soc.*, 1954, **76**, 1381.

KOEPFLI, J.B. Chemical investigation of *Rauwolfia caffra*. I. Rauwolfine. *J. Amer. chem. Soc.*, 1932, **54**, 2412-18.

KORZUN, B.P. et al. Paper chromatographic evaluation of *Rauwolfia* species. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1957, **46**, 720-723.

KRESS, R. Chemical and medicinal aspects of *R. serpentina* (in German). *Pharmazie*, 1953, **8**, 726-728.

LATTANZI, V. Reserpine, the alkaloid of *R. serpentina* (in Italian). *Boll. chim. farm.*, 1955, **94**, 495-8.

LEE, CHUAN-PU. *Rauwolfia* alkaloids. *Chemistry (Quart. Chinese Chem. Soc. Formusa)*, 1955, No. 4, 349-67.

LESSER, M.A. *Rauwolfia serpentina*. *Drug & Cosmet. Ind.*, 1954, 74, 500-1, 589-95.

LEWIS, J.J. The *Rauwolfia* alkaloids. *J. Pharm.* (Lond.), 1956, **8**, 465-94.

LJUNGBERG, S. Chemical evaluation of *Rauwolfia serpentina* (in Swedish). *Svenska. Farmac.*, 1957, **61**, 305-318.

LJUNGBERG, S. *Rauwolfia serpentina*, estimating of alkaloids. *J. Pharm.* (Lond.), 1957, **9**, 777.

LOGEMANN, W. et al. Simplified *Rauwolfia* alkaloid models. I. Tetrahydro-4-craboline and hexahydroyohimbane derivatives. *Chem. Bericht.*, 1955, **88**, 1952-56.

LOGEMANN, W. et al. Simplified *Rauwolfia* alkaloid models. II. Preparation of derivatives of 15: 16: 17: 18: 19: 20-hexadehydro-18-hydroxy-17:19-dimethoxy-yohimbane. *Chem. Bericht.*, 1956, **89**, 1043-1046.

MCALEER, W.J. et al. Plant resources of reserpine. *Chem. & Ind.*, 1956, 1387.

MACHOVICOVA, F. Chromatographic separation of reserpine, reserpic acid and yobimbine on paper (in Czech.). *Ces. farm.*, 1957, **6**, 310-311.

MACHOVICOVA, F. et al. Determination of reserpine, ajmaline and serpentine in mixtures (in Czech). *Ces. farm.*, 1957, **6**, 584-586.

MCMULLEN, W.H. et al. Analytical methods for reserpine. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 446-53.

MACPHILLAMY, H.B. et al. *Rauwolfia* alkaloids, 19: Constitution of deserpidine and reserpine. *J. Amer. chem. Soc.*, 1955, **77**, 4335-43.

MAMMARELLA, A. *The Rauwolfia* (in Italian). *Minerva Pharmaceutica* (Torino), 1955, **4**, 12-15. (Extraction of the alkaloids and pharmacology).

MANSKE, R.H.F., and HOLMES, H.L. (*Eds.*). Alkaloids: Chemistry and physiology. New York, Academic Press, 1952. (Alkaloids of *Rauwolfia* species, Vol. II, pp. 424-29).

MARINI-BETTOLO, G.B. Recent advances in the chemistry of natural products from Latin American flora. *Svensk farm tidskr.*, 20 Jan. 1955, **59**(2), 25-30.

MARQUIS, D.G. et al. Chemistry and mode of action of tranquillisers. *Ann. N.Y. Acad. Sci.*, 1957, **67**, 685-700 (includes *Rauwolfia* alkaloids).

MINER, ROY W. (*Ed.*). Reserpine (Serpasil) and other alkaloids of *R. serpentina:* Chemistry, pharmacology and clinical applications. *Ann. N. Y. Acad. Sci.*, 1954, **59**, 140.

MONSEUR, X. Study on reserpine in *Rauwolfia* of the Belgian Congo and determination. *J. Pharm. Belg.*, 1957, **39**, 39-43.

MOOKERJEE, Miss ASIMA (*now* CHATTERJEE). The alkaloids of *Rauwolfia canescens*, Linn. Pt. I. *J. Indian chem. Soc.*, 1941, **18**, 33-39.

MOOKERJEE, ASIMA. The alkaloids of *Rauwolfia canescens*, Linn. Pt. II. *J. Indian chem. Soc.*, 1941, **18**, 485-488.

MOOKERJEE, ASIMA. Rauwolscine and derivations. *J. Indian chem. Soc.*, 1943, **20**, 11.

MOOKERJEE, ASIMA. Function of rauwolscine in *R. canescens*, Linn. *Sci. & Cult.*, 1942, **8**, 40-41.

MORI, S. and TAKITA, H. The total synthesis of reserpine, a review. *Kagaku no Ryoiki*, 1957, **11**, 139-145.

MORS, W.B. and ZALTZMAN, P. Alkaloids of two Brazilian *Apocyanaceae*, *R. grandiflora* Mart. and *Lochnera* (*Vinca*) *rosea* (L). Reichb. var. *alba* (Sweet) Hub. *Chem. & Ind.*, 17 Mar. 1956, **11**, 173-74.

MOZA, B.K. Volumetric estimation of the total alkaloids of *R. serpentina*. *J. Instn. Chem. India*, 1958, **30**, 113-15.

MUKHERJEE, D. et al. Chemistry of ajmaline. Rauwolfine of Van Itallie and Steenhauer. *Experientia*, 1949, **5**, 215-17.

MULLER, J.M. The alkaloids of *Rauwolfia ligustrina* R. & S. Rangstin, a new alkaloid resembling reserpine (in German). *Experientia*, 1957, **13**, 479-481.

MULLER M. et al. Reserpine, the sedative compound from *R. serpentina* (in German). *Experientia*, 1952, **8**, 358 (announcing the discovery of the new alkaloid, reserpine).

NEUBERN de TOLEDO, TH. A., and WASICKY, R. The alkaloid content of Brazilian *Rauwolfia sellowii;* some reactions and the histochemical identification of the alkaloids (in German). *Sci. pharm.*, 1954, **22**, 217-24.

NEUSS, N. and BOAZ, H.E. *Rauwolfia* alkaloids. V. Stereochemical correlation of some indole alkaloids from the infrared spectra. *J. org. Chem.*, 1957, **22**, 1001.

NEUSS, N. et al. *Rauwolfia serpentina* alkaloids. I. Structure of reserpine. *J. Amer. chem. Soc.*, 1954, **76**, 2463-66.

NEUSS, N. et al. *Rauwolfia* alkaloids. II. Isolation and characterization of two new alkaloids from *R. serpentina*, Benth. *J. Amer. chem. Soc.*, 1954, **76**, 3234.

NEUSS, N. et al. *Rauwolfia* alkaloids. III. Recanescine, a new sedative principle of *R. canescens*, L. *J. Amer. chem. Soc.*, 1955, **77**, 4087-90.

NEUSS, N. et al. Structure of reserpine. *J. Amer. chem. Soc.*, 1953, **75**, 4870-71 (correction at p. 6363).

NEUWALD, F. and LOGES, W. Total alkaloid determination in *Rauwolfia* roots (in German). *Arch. Pharm* (Berlin), Apr. 1956, **289**(4), 226-31.

NEUWALD, F. and LOGES, W. Withania root as the falsification of *Rauwolfia* root (in German). *Arch. Pharm.* (Berlin), 1956, **289**, 604-8.

A new *Rauwolfia* alkaloid discovered (Deserpidine). *Medicus*, Apr. 1955, **10**(1), 41.

New roads to reserpine. *Chem. Eng.*, 1955, **33**, 1074.

NOGRADI, TAMAS. Investigations into *Rauwolfia* alkaloid models. I. Tryptamine and gramine derivatives. *Monatsch.*, 1957, **88**, 768-777.

ONDA, M. et al. Analogies of *Rauwolfia* alkaloids. I. Synthesis of 3-substituted indoles. II. Synthesis of tryptamine. *J. pharm. Soc. Japan*, 1956, **76**, 409-12, 472-73; (English summary, pp. 409, 472).

PAKRASHI, S. Thesis, Calcutta Univ., 1954.

PAKRASHI, S.C. et al. IX. *Rauwolfia* alkaloids, (4): Isolation of reserpine and other alkaloids from *R. sellowii* Muell. Argov. *J. Amer. chem. Soc.*, 1955, **77**, 6687-89.

PARIS, R. Plants containing alkaloids and their value in therapy: *Rauwolfia Veratrum, Holarrhena*, etc. (in Spanish). *Farmacognosia*, 1956, **16**, 239-53.

PARIS, R. Some plants with alkaloids recently used in therapy (*Rauwolfia, Veratrum, Holarrhena*, etc.). *Farmacognosia*, 1956, **41**, 239-253.

PARIS, R. and DILLEMANN, G. Assay of *Rauwolfia;* examination of two species from the Belgian Congo: *R. inebrians* H. Schum, and *R. obscura* K. Schum (in French). *Ann. pharm. franc.*, 1956, **14**, 505-18.

PARIS, R. and DILLEMAN, G. Assay of *Rauwolfia*. II. *Rauwolfia vomitoria* and some related African species. *Ann. pharm. franc*, 1957, **15**, 310-321.

PARIS, R. et al. Tests on *Rauwolfias*. III. *Rauwolfia nacrophylla*, Stapf. (in French). *Ann. pharm. franc.*, 1957, **15**, 360-367.

PEETS, E.A. et al. Biosynthesis of C^{14} reserpine by *Rauwolfia* plants. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1958, **47**, 280-281.

PETROW, V. Synthesis of reserpine. *Pharm. J.* 1956, **176**, 334-35.

PHILLIPS, DONALD, and CHADHA, MOHINDRA S. Alkaloids of *R. serpentina*, Benth. *Chem. & Ind.* 9 Apr. 1955, 414-15.

PHILLIPS, DONALD, and CHADHA, MOHINDRA S. The alkaloids of *R. serpentina* Benth. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 553-67.

PILLAY, P.P. et al. Assay of *R. serpentina* preparations. *Indian J. Pharm.*, 1955, **17**, 95-97.

PILLAY, P.P. et al. Paper chromatography of *Rauwolfia* extracts. *Indian J. Pharm.*, 1955, **17**, 91-94.

PITRE, D. Complete synthesis of reserpine (in Italian). *Farmaco; Edizione scientifica* (Pavia), 1956, **11**, 690-4.

PODLEWSKA, A. Reserpine, an alkaloid of *R. serpentina*, and its action (in Polish). *Farmacja Polska*, 1955, **11**, 80-3.

PODLEWSKI, J.K. *R. serpentina*, substitution, isolation of alkaloids, preparation (in Polish). *Farmacja Polska*, 1955, **11**, 84-9.

POISSON, J. et al. Isolation of reserpine from roots of *R. vomitoria*, Afz. (in French). *C. R. Acad. Sci.* (Paris), 1954, **238**, 1607-9.

POISSON, J. et al. Presence in the roots of *R. vomitoria*, Afz. of the trimethoxy-benzoic ester of an alkaloid of the ajmaline type. *C. R. Acad. Sci.* (Paris), 1955, **241**, 1840-42.

POISSON, J. et al. Raumitorine and seredine, two new alkaloids isolated from the roots of *Rauwolfia vomitoria* (in French). *C. R. Acad. Sci.* (Paris), 19 July 1954, 302-304.

POISSON, J. et al. The structure of sarpagine and of lochnerine (in French). *Bull. Soc. chim. de Franc*, 1957, 610.

POPELAK, A. et al. New alkaloids of *R. serpentina*. *Naturwissenschaften*, 1953, **40**, 625.

RAJAGOPALAN, S. Recent developments on *R. serpentina*, Benth. *J. sci. industr. Res.*, 1954, **13B**, 77.

RAKSHIT, BITHIKA. Alkaloids of *R. serpentina*, Benth. *J. Instn. Chem. India*, 1955, **27**, 5-18.

RAKSHIT, BITHIKA. Chandrine, another alkaloid from *R. serpentina*, Benth. *Indian Pharm.*, 1954, **9**, 226-7.

RAKSHIT, BITHIKA. Researches on *R. serpentina*, Benth. *Indian Pharm.*, 1953, **8**, 201-202.

RAO, D.S. and RAO, S.B. Chemical investigation of *Rauwolfia micrantha*. *Indian J. Pharm.*, 1956 **18**, 202-3.

RAO, D.S. and RAO, S.B. Isolation of reserpine from *R. micranta*, Hook.f. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1955, **44**, 253.

Rauwolfia serpentina. Annual Rept., Director, Research Instt. A & U. Tibbi College, Delhi, 1937, pp. 2-3; (*see also* under S. Siddiqui).

RAY, LILABATI. Structure of rauwolscine by X-ray and optical method. *Indian J. Pharm.*, 1956, **18**, 199-202.

RAYMOND-HAMET, M. Ajmaline, serpentinine. *C. R. Acad. Sci.* (Paris), 1949, **229**, 1165-1166.

RAYMOND-HAMET, M. An attempt to classify the alkaloids of *Rauwolfia* (*Apocynacaes*) (in French). *C. R. Acad. Sci.* (Paris), 1953, **237**, 1435-37.

RAYMOND-HAMET, M. The isomers of yohimbine. *C. R. Acad. Sci.* (Paris), 1952, **234**, 555-8 (including rouwolscine).

RAYMOND-HAMET, M. Tentative classification of the alkaloids of *Rauwolfias* (*Apocynacaes*) (in French). *C. R. Acad. Sci.* (Paris), 1953, **237**, 1435.

RAYMOND-HAMET, M. To what type of alkaloids does raubasine belong? (in French). *C. R. Acad. Sci.* (Paris), 1954, **238**, 1338.

Rescinnamine. *J. Amer. med. Ass.*, 1958, **167**, 994-995.

RITEY, HELEN and SPRINKS, A. Biological assessment of tranquillisers. *J. Pharm.* (London), Nov. 1958, **10** (11), 657-671 (includes reserpine)

RINDL, M. and GROENWOULD, P.W.G. Chemistry of *Rauwolfia natalensis*. *Trans. roy. Soc. South Afr.*, 1932, **21**.

ROBINSON, ROBERT. Further observations on the chemistry of ajmaline. *Chem. & Ind.*, 1955, 285.

ROSE, HARRY A. Crystallographic data: Ajmalicine, ajmalicine hydrate, and *py*-tetrahydroserpentinol. *Analyt. Chem.*, 1955, **27**, 469-70.

ROSE, HARRY A. Reserpine and reserpic alcohol hydrate. *Analyt. Chem.*, 1954, **26**, 1245.

ROY, P.K. et al. Biological assay of preparations of *Rauwolfia serpentina*, Benth. for their hypopietic potency (a preliminary report). *Bull. nat. Inst. Sci. India*, 1955, No. 4, 69-70.

RUBIN, B. et al. Bioassay of *Rauwolfia* roots and alkaloids. *J. Pharmacol.*, 1957, **120**, 125-135.

RUGGIERI, RUGGERD. Solubilization of reserpine. *Boll. chim. farm.*, 1957, **96**, 264-265.

RUIZ GIJON, J. and RIO IBANEZ, J. del. Studies on *Rauwolfia serpentina*, Benth., and some of its alkaloids. *Ann. Inst. Farmacol. esp.*, 1955, **4**, 367-398.

RUIZ, GIJON J. and RIO IBANES, J. del. Studies on *R. serpentina*, Benth. and its alkaloids. Pt. II (in Spanish). *Farmacognosia*, July-Sept. 1955, **15**(37), 221-59.

SAHLI, M. Experiments on the separation of *Rauwolfia* alkaloids by means of electrophoresis (in German). *Pharm. Acta Helv.*, Jan. 1958, **33**(1), 1-9.

ST. ANDRE, A.F. et al. *Rauwolfia* alkaloids. Pt. 24: Alkaloids of *Tonduzia longifolia* (A.D.C.) Mfg. *J. org. Chem.*, 1956, **21**(4), 480-81.

SAKAL, E.H. and MERRILL, E.J. Ultraviolet spectrophotometric determination of reserpine. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1954, **43**(12), 709-15.

SCHLITTLER, E. Chemistry of *Rauwolfia* alkaloid including reserpine. *Ann. N. Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 1-7.

SCHLITTLER, E. and FURLENMIER, A. Alkaloids of *R. semporflorens* Schlechter. *Helv. chim. acta*, 1953, **36**(5), 996-99.

SCHLITTLER, E. and SCHWARZ, H. On the alkaloid serpentine from *R. serpentina*, Benth. (in German). *Helv. chim. acta*, 1950, **33**(6), 1463-77.

SCHLITTLER, E. et al. Isolation of alstonin from the African species of *Rauwolfia* (in German). *Helv. chim. acta*, 1952, **35**(1), 271-76.

SCHLITTLER, E. et al. *Rauwlolfia* alkaloids. *Angew. Chem.*, 1954, **66**, 386-90.

SCHLITTLER, E. et al. *Rauwolfia* alkaloids. XVI. Deserpidine, a new alkaloid from *R. canescens*. *Experientia*, 1955, **11**(2), 64-65.

SCHLITTLER, E. et al. Reserpine, a new alkaloid of *R. serpentina*, Benth. *Experientia*, 15 Mar. 1954, **10**(3), 133-4.

SCHLITTLER, E. et al. Serpentinine alkaloid from *R. serpentina*, Benth. (in German). *Helv. chim. acta*, 1954, **37**(6), 1912-20.

SCHROFF, M.L. and BHATIA, R.L. A method of assay for *R. serpentina*. *Indian J. Pharm.*, 1941, **3**, 59-61.

SCHULER, B.O.G. and WARREN, F.L. *Rauwolfia* alkaloids. Pt. I. Reserpine and ajmaline from *R. natalensis*, Sond. *J. chem. Soc.*, 1956, 215-16.

SCHULER, B.O.C. and WARREN, F.L. Reserpine from *R. cumminsii*, Stap. *Chem. & Ind.*, 1955, 1593.

SHAH, C.N. and SIRSI, M. Method of biological standardisation of crude total alkaloids of *R. serpentina*. *Curr. Sci.*, 1955, **24**, 39-40.

SHARMA, V.N. et al. Chemistry and pharmacology of *Rauwolfia*. *J. sci. industr. Res.*, 1954, **13A**(6), 261-272.

SHEPPARD, H. et al. Method for determination of serpasil. *Fed. Proc.*, 1954, **13**, 404.

SIDDIQUI, R.H. Chemical examination of the roots of *R. serpentina*, Benth., with special reference to its alkaloidal constituents, and studies in the alkaloids of *Holarrhena antidysenterica*. Aligarh Univ. Ph.D thesis, 1934.

SIDDIQUI, R.H. Review of the work done in the sub-continent of Indo-Pakistan on alkaloidal plants. (Presidential address, Section of Chemistry). *Proc. Pakist. Sci. Conf.*, 1958, **10**(2), 39 pp. (*Rauwolfia* alkaloids, C7-C14, C25-C29).

SIDDIQUI, S. Alkaloids of *R. serpentina*, Benth. *J. Indian chem. Soc.*, 1939, **16**, 421-2.

SIDDIQUI, S. Isolation of new hypotensive factor from the roots of ajmaline *Rauwolfia serpentina*, Benth.; ajmaline series of bases. *Chem. & Ind.*, 21 Sept. 1957, 1270-1271.

SIDDIQUI, S. Nomenclature of ajmaline : Correspondence between Dr. Siddiqui and Prof. Koepfli, etc. (*Annual Rept., Director, Research Instt., A. & U. Tibbi College*), Delhi, 1932-33, pp. 58-71).

SIDDIQUI, S. Studies in the alkaloids of *Rauwolfia serpentina*, Benth. and the mode of their occurrence. (Isolation of a new hypotensive factor and other alkaloidal complexes from the roots). *Pakist. J. sci. industr. Res.*, 1958, **1**(1), 3-5.

SIDDIQUI, S. Studies in the isolation of plant alkaloids. *Proc. Muslim Ass. for the Adv. Sci.* (Aligarh), Nov. 1932, (*R.serp.*, pp. 49-54); (also *Annual Rept. of the Director, Research Instt., A. & U. Tibbi College*, Delhi, 1932-33, p. 4).

SIDDIQUI, S. and MURTI, G.G.K. Alkaloids of *R. serpentina*, Benth. (Survey of work done in the Chemical Labs. of the C.S.I.R., 1940-41, pp. 8-9). New Delhi, 1947, 68 pp.

SIDDIQUI, S. and SIDDIQUI, R.H. Alkaloids of *R. serpentina* Benth. Pt. I. *J. Indian Chem. Soc.*, 1932, **9**, 539-44; (also in *Annual Rept. of the Director, Resarch Instt., A. & U. Tibbi College*, 1932-33, pp. 35-39, Delhi, 1933).

SIDDIQUI, S. and SIDDIQUI, R. H. Alkaloids of *R. serpentina*, Benth. Pt. II. *J. Indian chem. Soc.*, 1935, **12**, 37-47.

SIDDIQUI, S. and SIDDIQUI, R. H. Chemical examination of the roots of *R. serpentina*, Benth. *J. Indian chem. Soc.*, 1931, **8**, 667-680 (also *Annual Rept. of Director, Research Instt., A. & U. Tibbi College*, pp. 22-24, Delhi, 1932-33).

SMITH, R.G. Federal ruling on products containing reserpine and *Rauwolfia* products issued by the Food and Drug Administration of the U.S. Deptt. of Health, Education and Welfare. *Rhode Island med. J.* (Providence), 1956, **39**, 512-14.

Source, characters and properties of *R. serpentina*. *Chemist & Druggist*, 1954, **162**, 214-16.

STAUFFACHER, D. et al. *Rauwolfia* alkakoids, 7: Sarpagin (in German). *Helv. chim. acta*, 1957, **40**, 508.

STEENHAUER, A.J. Alkaloids of *R. serpentina*, Benth. *Pharm. Weekbl.*, 1956, **91**, 216-24.

STEENHAUER, A.J. Reserpine, an alkaloid of *Rauwolfia serpentina* Benth., 2 pts. (in Dutch). *Pharm. Weekbl.*, 13 Mar. 1954, **89**, 11-12; 28 Aug. 1954, **89**, 35-36.

STOLL, A. and HOFMANN, A. Alkaloids from the leaves and roots of *R. canescens*, L. *Soc. Biol. Chemists, India, Silver Jubilee Souvenir*, 1955, pp. 248-58.

STOLL, A. and HOFMANN, A. Canescine and pseudoyohimbine from roots of *R. canescens*. *J. Amer. chem. Soc.*, 1955, **77**(3), 820-21; *J. Pharm.* (Lond.), 1955, **7**(7), 480.

STOLL, A. and HOFMANN, A. Canescine and ψ-yohimbine from the roots of *R. canescens*. *J. Amer. chem. Soc.*, 1955, **77**, 820-21.

STOLL, A. and HOFMANN, A. Sarpagin, a new alkaloid of *R. serpentina*, Benth. (in German). *Helv. chim. acta*, 1953, **36**(5), 1143-47.

STOLL, A. et al. Four alkaloids from leaves of *Rauwolfia canescens* (in German). *Angew. chem.*, 1955, **67**, 268-

STOLL A. et al. *Rauwolfia* alkaloids. IV. Alkaloids from the leaves of *R. canescens*, L. *Helv. chim. acta*, 1955, **38**, 270-83.

SZALKOWSKI, C.R. and MADER, W.J. Determination of reserpine. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1956, **45**(9), 613-7.

TALAPATRA, S.K. and CHATTERJEE, ASIMA. On the constitution of sarpagine, the minor alkaloid of *Rauwolfia micrantha*, Hook and *Rauvolfia beddomei*, Hook. F. (Lett.). *Sci. & Cult.*, 1956, **22**(12), 692-693.

THOMAS, A.F. Constitution of sarpagine. *Chem. & Ind.*, 1954, 488-489.

THORPE's Dictionary of applied chemistry. 4th ed. London. Longmans, Green. (*R. serpentina*, **10**, 1950, pp. 1475-77).

ULSHAFER, P.R. et al. *Rauwolfia* alkaloids, pt. 28: Isolation of raujemidine, an isomer of reserpine, from *R. canescens*. *J. org. Chem.*, 1956, **21**(8), 923.

ULSHAFER, R. et al. *Rauwolfia* alkaloids. XXV. Renoxydine, a N-oxide alkaloid from *Rauwolfia vomitoria*. *C.R. Acad. Sci.* (Paris), 12 June 1957, **244**, 2988-2991.

VAN ITALLIE, L. and STEENHAUER, A.J. *Rauwolfia serpentina*, Benth. *Arch. Pharm.* (Berlin), **270**, 1932, 313-22.

VAN ITALLIE, L. and STEENHAUER, A.J. *Rauwolfia serpentina*, Benth. *Pharm. Weekbl.*, 1932, **69**(14), 334-48.

VAN TAMELEN, E.E. and HANCE, P.D. Stereochemical formulation of reserpine. *J. Amer. chem. Soc.*, 1955, **77**(17), 4692-93.

VAN TAMELEN, E.E. and TAYLOR, C.W. Alkaloids of *Rauwolfia*. Structure of raunescine and isoraunescine. *J. Amer. chem. Soc.*, Oct. 1957, **79**, 5256-5262.

VAN TAMELEN, E.E. et al. D-E-*cis*- Ring juncture of reserpine. *J. Amer. chem. Soc.*, 1955, **77**, 3930.

VEJDELEK, Z.J. Alkaloids of *Rauwolfia* plants (in Czech.). *Cesk. farm.*, Apr. 1955, **4**(3), 136-45.

VENKATESWARAN, N. and CHATTERJEE, A. Stereochemistry of heterocyclic compounds. I. Conformational analysis of ajmaline, ajmalidine, serpenine and rauwolfinine—the dihydroindole alkaloids of *Rauwolfia*. *J. Indian chem. Soc.*, 1958, **35**, 363-65.

VERGARA, B.U. Extraction of reserpine and other alkaloids from Colombian *R. hirsuta*. *J. Amer. chem. Soc.*, 1955, **77**, 1864; (also in *Amer. Soc. Biol. Bogota*, 1955, **6**(6), 227-233).

WEHMER C. Die Pflanzenstoffe. Jena, Gustav Fischer, 1929-1935 (*R. serp.*, Vol. II, p. 981; Supp., p. 171).

WEISENBORN, F.L. and APPLEGATE, H.E. Synthesis of compounds related to reserpine. Conversion of an intermediate into 16-methyl-yohimbane. *J. Amer. chem. Soc.*, 1956, **78**, 2021-22.

WEISENBORN, F.L. and DIASSI, P.A. Reaction of *Rauwolfia* alkaloids with mercuric acetate. Conversion of 3-*iso*-reserpine into reserpine. *J. Amer. chem. Soc.*, 1956, **78**, 2022-23.

WEISENBORN, F.L. et al. Isolation of δ-yohimbine and a new related alkaloid from *R. serpentina*, Benth. *Chem. & Ind.*, 1954, 375.

WENKERT, E. and ROYCHAUDHURI, S. K. A general method of determination of the stereochemistry of certain indole alkaloids. The stereoconfiguration of serpentine and alsonine. *J. Amer. chem. Soc.*, 1957, **79**, 1519.

Wondrous root. *Ind. & Eng. Chem.*, Dec. 1954, **46**, Supp. 17A-18A. (*Rauwolfia*).

WOODSON, R.E. et al. Isolation of alkaloids from *Rauwolfia* spp. Isolation of sarpagine, yohimbine and δ-yohimbine from the roots of *R. heterophylla*, Roem et Schult. Isolation of reserpine, ajmaline, and sarpagine from the roots of *R. indecora*. *Pharm. Bull.* (Japan), 1955, **3**, 319-20.

WOODWARD, R.B. Recent developments in the chemistry of natural substances. *Angew Chem.*, 1956, **68**, 13 (structure of ajmaline).

(WOODWARD, R.B.) Reserpine synthesized: Harvard's Woodward completes total synthesis of reserpine; Ciba and Squibb find alternate steps. *Chem. Engng. News.*, 27, May 1956, **34**(19), 2240-42; (also in the Notes & News Section of *J. sci. industr. Res.*, 1956, **15A**(10), 472).

WOODWARD, R.B. et al. A simplified route to a key intermediate in the total synthesis of reserpine. *J. Amer. chem. Soc.*, 1956, **78**(11), 2657.

WOODWARD, R.B. et al. Total synthesis of reserpine. *J. Amer. chem. Soc.*, 1956, **78**, 2023-25.

YAKHONTOV, L.N. Alkaloids of *Rauwolfia*. (in Russian). *Uspekh. Khim.* (Moscow), 1957, **26**, 239.

YAKHONYON, L.N. The structure and synthesis of reserpine (in Russian). *Med. Prom. S.S.S.R.*, 957, **11** (7), 6-13.

YAMAGUCHI, KAZUTAKA et al. Determination of alkaloids from *Rauwolfia serpentina*. I. Separation of reserpine from total alkaloids by paper electrophoresis. *Yakugaku Zashi*, 1957, **77**, 337-40.

YONKMAN, F.F. (ed.) Symposium; Reserpine (Serpasil) and other alkaloids of *Rauwolfia serpentina;* chemistry, pharmacology and clinical application. *Ann. N.Y. Acad. Sci.*, 1954, **59**, 1-147.

II. PHARMACOLOGY AND THERAPEUTICS

ABD-EL-NABY, S. Reserpine in the treatment of organic and senile psychosis. *J. Egypt. med. Ass.*, 1957, **40**(9), 666-681.

ABDUL WAHED, A.K.M. The action of serpasil in hypertension. *Medicus* (Karachi), May 1956, **12**(2), 47-55.

ABECASIS, L. *Rauwolfia serpentina* in therapy of essential hypertension (in Portuguese). *Med. Contemp.*, 1954, **72**(9), 437-44.

ABELY, P. and LAB, P. Semiological and theoretical findings derived from the use of neuroleptics (in French). *Ann. Med. Psychol.* (Paris), Nov. 1957, 749-754 (includes reserpine).

ABLAD, BENGT. Adrenergic block by reserpine in man. *Acta. pharmacol. tox.* (Kbh.), 1957, **13**, 213-224.

ABRAHAMS, D.G. and WILSON, C. Effect of hypotensive drugs on renal function in chronic renal disease. *Lancet*, 12 Jan. 1957, **272**(6959), 68-74 (includes reserpine).

ABRAMS, ROBERT E. and TICE, LINWOOD F. Modern medicinals in review. *Amer. J. Pharm.*, 1955, **127**(1), 4-22. (Antihypertensives : *Rauwolfia*, p. 10-11).

ABSE, D.W. et al. Use of reserpine in the management of acute mental disturbance on an in-patient service; preliminary report. *J. nerv. ment. Dis.*, Sept. 1956, **124**(3), 239-245.

ACHELIS, J.D. and KRONEBERG, G. The action of the total alkaloids of *Rauwolfia serpentina* and of reserpine on the blood-pressure of dogs. (in German). *Arzneimittel Forschung*, 1955, **5**, 204-208.

ACHOR, R.W. and BERGE, K.G. Treatment of hypertension using reserpine combined with a new analeptic agent, methyl-phenidylacetate hydrochloride; limitation of usefulness. *Antibiotic Med.*, Oct. 1957, **4**(10), 602-608.

ACHOR, R.W. and HANSON, N.O. Hypertension treated with *Rauwolfia canescens;* a comparison with *Rauwolfia serpentina*. *New Engl. J. Med.*, 4 Oct. 1956, **255**(14), 646-650.

ADAMSON, J.P. et al. Use of tranquillizers for mentally deficient patients. *Amer. J. Dis. Child.*, Aug. 1958, **96**(2), 159-164 (includes reserpine)

ADELSON, S. and LADERACH, D.C. Reserpine in the elderly hypertensive patients; observations in 33 patients. *Harper Hosp. Bull.* (Detroit), Mar.-Apr. 1957, **15**(2), 43-51.

ADLER, H. Use of serpasil on a disturbed ward. *Dis. nerv. Syst.*, 1955, **16**(4), 122-4.

ADLER, H. Use of reserpine on a chronic disturbed ward. *Int. Rec. Med.*, Feb. 1958, **171**(2), 83-86.

ADOMKIEWICZ, L. et al. Treatment of hypertension with *Rauwolfia* (in French). *Un. med. Canad.*, 1954, **83**(10), 1087-91.

AGNOLETTO, A. Clinical observations on the use of a combination of reserpine, hydroquinidine and adenosine in the treatment of cardiac arrhythmia and coronary disease (in Italian). *Minerva cardioangiol.*, Oct. 1956, **4**(10), 622-630.

AHLQUIST, R.R. Depressor action of reserpine. *Fed. Proc.*, Mar. 1957, **16**, 277 (abstract).

AIROLDI, J.C. Action of *Rauwolfia serpentina* in hypertension (in Spanish). *Prensa. med. argent.*, 3 Aug. 1956, **43**(31), 2393-2396.

AKACIC, B. *Rauwolfia* drugs. *Farm. Glasn.*, 1956, **12**, 422-432.

ALAMANNI, V. Considerations on the use of reserpine and phenyl (α-piperidyl) acetic acid in the treatment of pre-operative anxiety states (in Italian). *Riv. ostet. ginec.*, Mar. 1957, **12**(3), 152-159.

ALAMANNI, V. Notes on the use of reserpine in post-operative tachycardia in gynaecology (in Italian). *Gazz. med. ital.*, Feb. 1958, **117**(2), 51-56.

ALBRECHT, W. Increase in the glycogen content of brain and changes in various enzymes in the brain and intestine following reserpine treatment in the mouse (in German). *Klin. Wschr.*, 1957, **35**, 588-590.

ALLEN, EDGAR V. et al. Medical treatment of essential hypertension. *Sind med. J.*, Dec. 1954, **27**(3), 103-119. (*R. serp.*, pp. 116-19).

ALLY, M.M. Recent advances in the treatment of essential hypertension. *J. Pakist. med. Ass.*, Oct. 1956, **6**(5), 6-12. (*R. serp.* pp. 10-11).

ALLY, M.M. Studies on the hypnotic effect of *R. serpentina*. *Medicus* (Karachi), Nov. 1954, **9**(2), 37-49.

ALTSCHULE, M.D. Use of chlorpromazine and reserpine in mental disorders. *New Engl. J. Med.*, 15 Mar. 1956, **254**(11), 515-19.

ALTSHULE, M.D. et al. Carbohydrate metabolism in brain disease. Lack of effect of chlorpromazine and reserpine on abnormal carbohydrate metabolism in chronic schizophrenia. *Arch. intern. Med.*, June 1957, **99**(6), 892-895.

ANAND, B.K. et al. Effects of reserpine on blood-pressure responses evoked from the hypothalamus. *Brit. J. Pharmacol.*, 1957, **12**, 8-11.

ANDERSEN, E. and KEMP, A. Clinical results of treatment with serpasil in a psychiatric hospital (in German). *Acta Psychol. Neurol.* (Suppl.), 1957, **117**, 1-82.

ANDERSSON, C.J. Adrenergic block on isolated vessel preparation. *Acta. pharmacol. tox.* (Kbh.), 1957, **13**(3), 225-227.

ANDREAE, E. and SMITH, F.E. The effect of oral reserpine on renal plasma flow in hypertension; clinical study of fifteen patients. *Amer. J. med. Sci.*, July 1955, **230**(1), 45-8.

ANGYAN, A. Some experimental data on the effects of serpasil on higher nervous function (in Hungarian). *Mag. Tud. akad. Biol. Orv. Oszt. Kozl.*, 1956, **8**(1-2), 77-78.

ANTONELLI, F. Reserpine in psychosomatic practice and research. *Acta psychother.* (Basel), 1956, **4**(4), 346-351.

ARENA, E. and STEFANO, L. Action of pure alkaloid of *Rauwolfia serpentina* on the glucose content in a group of mental patients (in Italian). *Acta neurol.* (Napoli), 1956, **11**(2), 407-10.

ARIAN, E. and CUNIOLO, A. Effects of various neuroleptic substances on the central nervous system: Inhibition of excitatory phenomena of subcortical origin (in Italian). *Minerva med.* (Torino), 24 Feb. 1957, **48**(16), 617-621.

ARIAN, E. and GOMIRATO, G. Experimental research on the inhibition of excitation states of subcortical origin by the use of chlorpromazine, reserpine; preliminary communication (in French). *Encephale*, 1956, **45**(4), 1264-1266.

ARMAS CRUZ, A. et al. Early results of therapy of arterial hypertension with pentolinium alone and combined with hydrazinophthalazine and *Rauwolfia* (in Spanish). *Rev. med. Chile*, 1954, **82**(9), 531-5.

ARMAS CRUZ, R. et al. *Rauwolfia serpentina* in therapy of benign arterial hypertension; preliminary report of 40 treated cases (in Spanish). *Rev. med. Chile*, 1955, **83**(5), 283-8.

ARMOUR, P.S. A regimen in acute alcoholism. *Ariz. Med.*, 1956, **13**(5), 169-72.

ARNOLD, A.L. and FREEMAN, H. Reserpine in hospitalised psychotics; a controlled study on chronically disturbed women. *Arch. Neurol. Psychiat.* (Chicago), Sept. 1956, **76**(3), 281-285.

ARNOLD, O.H. Treatment of chronic arterial hypertension (in German). *Therap. d. Gegenw.*, 1952, 167.

ARNOLD, O.H. and BOCK, K.D. New results in medicamentous treatment of arterial hypertonia (in German). *Dtsch. med. Wschr.*, 12 June 1953, **78**(24), 565; 879-83.

ARNOLD, O.H. and OERTEL, N. Further studies on the therapy of arterial hypertension with *Rauwolfia* (in German). *Z. kreisl Forsch.*, Apr. 1955, **44**(7-8), 310-21.

ARNOLD O.H. and PFISTERER, H. Therapy of hypertension with hypotensive drugs (in German). *Zeit. fur Kreislaufforschung* (Darmstadt), Apr. 1954, **43**(7-8), 265-86.

ARORA, R.B. Antiveratrinic action of *R. serpentina* alkaloids. *Arch. int. Pharmacodyn.*, 1956, **106**, 28.

ARORA, R.B. and MADAN, B.R. Antiarrhythmics. VI. Ajmaline and serpentine in experimental cardiac arrhythmias. *J. Pharmacol.*, May 1956, **117**(1), 62-7.

ARORA, R.B. and MADAN, B.R. Studies in indigenous drugs. Pt. VI. Ajmaline and serpentine in experimental auricular fibrillation. A preliminary report. *Indian. J. Pharm.*, 1956, **18**(6), 247-50.

ARRIETA-ALVAREZ, F. Hypertension treatment with Nokhel-reserpine-phenobarbital combination. *Rev.Clin. esp.*, 1957, **65**(6), 402-406.

AUBERTIN, E. New drugs in hypertension (in French). *J. Med. Bordeaux*, 1954, **131**(12), 1368-77.

AUDIBERT, A. et al. Experiments on the action of reserpine in female genital endocrinology (in French). *Bull. Fed. Soc. gyn. Obstet. fr.*, Aug.-Sept. 1956, **8**(4), 444.

AVAZIAN, G.H. Pharmacothe.apy for mental disorders, clinical use of the new drugs: Chlorpromazine, reserpine, meprobamate. *Amer. Practit.*, Dec. 1957, **8**(12), 1943-1946.

AVENARIUS, R. Mechanism of action of *Rauwolfia* alkaloids and phenothiazine derivatives in schizophrenia (in German). *Nervenarzt*, 20 Oct. 1956, **27**(10), 454-458.

AVOL, M. and VOGEL, P.J. Treatment of delirium tremens with reserpine (Serpasil); a preliminary report. *J. Amer. med. Ass.*, 17 Dec. 1955, **159**(16), 1516-20.

AYD, F.J. Thorazine and serpasil treatment of private neuropsychiatric patients. *Amer. J. Psychiat.*, July 1956, **113** (1), 16-21.

AYD, R.J. Electroconvulsive therapy combined with chlorpromazine and reserpine. *Int. Rec. Med.*, Dec. 1957, **170**(12), 31-36.

AYD, F.J. New approaches to the treatment of psychiatric disorders. *Maryland med. J.*, June 1958, **7**(6), 304-308 (includes reserpine).

AYERBE, A. and ACUNA, M. Results obtained with reserpine in psychiatric practice (in Spanish). *Sem. med.* (B. Aires), 16 Feb. 1956, **108**(7), 232-4.

AZIMA, H. The possible dream inducing capacity of the whole root of *Rauwolfia serpentina*. *Canad. Psychiat. Ass. J.*, Jan. 1958, **3**(1), 47-51.

AZIMA, H. et al. *Rauwolfia* alkaloids in mental syndromes. *J. Canad. med. Ass.*, Dec. 1955, **73**(11), 866-1.

BACHTOLD, M. and PLETSCHER, A. Influence of isonicotinic acid hydrazide on the body temperature of rabbits after reserpine, monomines, and chlorpromazine (in German). *Experientia*, 1957, **13**, 163-165.

BAIN, C.W. C. et al. Treatment of essential hypertension with pentolinium tartrate combined with *Rauwolfia* alkaloids. *Brit. med. J.*, 2 Apr. 1955, 817-8.

BANERJEE, A.P. and HAUSLER, H.F. Countercurrent distribution of soluble *Rauwolfia* alkaloids. *Bull. Calcutta Sch. trop. Med.*, 1955, **3**, 111-12.

BANERJEE, B.P. et al. *Rauwolfia serpentina* in functional disorders. *Bull. Calcutta Sch. trop. Med.*, 1957, **5**(1), 8-10.

BANERJEE, J.N. Pharmacology of the alseroxylon fraction of *Rauwolfia serpentina* and its mode of action. *Indian J. Pharm.*, 1956, **18**(6), 265-68.

BANERJEE, J.N. and LEWIS, J.J. A note on the pharmcology of the alkaloids of *R. serpentina*, Benth. *J. Pharm.* (London), 1955, **7**(1), 50-54.

BANSON, A. and DINAYUGA, A.K. Preliminary report on reserpine as an adjunct in therapy of thyro-toxicosis. *Philipp. J. Surg. Obstet. Gynec.*, 1958, **13**, 439-440.

BARISON, F. and MASSIGNAN, L. Observations on neurotic depressions with reference to a combined serpasil-ritalin treatment (in Italian). *Rass. neuropsich.*, 1956, **10**(5-6), 198-209.

BARKOV, N.N. Redergram in hypertension (in Russian). *Klin. med. Mosk.*, Mar. 1957, **35**(3), 88-93 (includes reserpine).

BARNETT, A.J. Treatment of severe arterial hypertension: Results from long term use of methonium compounds with and without the addition of reserpine. *Australian Ann. Med.*, Nov. 1956, **5**(4), 274-290.

BARRACLOUGH, C.A. and SAWER, C.H. Blockade of the release of pituitary ovulating hormone in the rat by chlorpromazine and reserpine: Possible mechanism of action. *Endocrinology*, Oct. 1957, **6**(4), 341-351.

BARRETT, B.M. and HANSEL, F.K. Reserpine, a new adjunct in the management of resistant headache patterns: A preliminary report. *Ann. N. Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 250-66.

BARRETT, J.E. Value of chlorpromazine hydrochloride and reserpine in relation to other methods used in treating mental illness. *Virginia med. (Semi-) Mont.*, 1955, **82**(9), 415-17.

BARRETT, W.E. et al. Action of Serpasil on gastrointestinal mobility and secretions. *Fed. Proc.*, 1954, **13**, 334.

BARRETT, W.W. et al. Study of the differential behavioral effects of reserpine, chlorpromazine, and a combination of these drugs in chronic schizophrenic patients. *Dis. nerv. Syst.*, June 1957, **18**(6), 209-215.

BARSA, J.A. and KLINE, N.S. Combined reserpine-chlorpromazine in treatment of disturbed psychotics. *Arch. Neurol. Psychiat.* (Chicago), Sept. 1955, **74**(3), 280-6.

BARSA, J.A. and KLINE, N.S. Combined reserpine-chlorpromazine therapy in disturbed psychotics. *Amer. J. Psychiat.*, Apr. 1955, **111**(10), 780.

BARSA, J.A. and KLINE, N.S. A comparative study of reserpine, chlorpromazine and combined therapy. *Arch. Neurol. Psychiat.* (Chicago), July 1956, **76**(1), 90-7.

BARSA, J.A. and KLINE, N.S. Reserpine in the treatment of psychotics with convulsive disorders. *Arch. Neurol. Psychiat.* (Chicago), July 1955, **74**(1),31-5.

BARSA, J.A. and KLINE, N.S. Treatment of two hundred disturbed psychotics with resperine. *J. Amer. med. Ass.*, 14 May 1955, **158**(2), 110.

BARSA, J.A. and KLINE, N.S. Use of reserpine in disturbed psychotic patients. *Amer. J. Psychiat.*, Mar. 1956, **112**(9), 684-91.

BARTFELD, H. Use of reserpine in psychogenic rheumatism, osteoarthritis and rheumatoid arthritis; a preliminary report. *J. Amer. med. Ass.*, 17 Dec. 1955, **159**(16), 1510-3.

BARTOSZWSKI, J. Trial of reserpine treatment in chorea minor (in Polish). *Neurol & c. polska*, Nov.-Dec. 1957, **7**(6), 853-858.

BARUCCI, M. Interpretation of the extra pyramidal syndrome caused by reserpine (in Italian). *Riv. Pat. nerv.*, 1957, **78**(2), 483-502.

BARUCCI, M. and MORI, F. Effects of reserpine combined with a psychoanaleptic drug on mental efficiency in the aged (in Italian). *Riv. Pat. nerv.* , 1957, **78**(3), 989-993.

BARUCCI, M. and MORI, F. Hyperkinetic crisis of hemiballistic type in a schizophrenic treated with reserpine (in Italian). *Rev. Pat. nerv.*, 1957, **78**(3), 1013-1016.

BARUK, H. et al. Action of reserpine on psychomotricity and experimental catatonia. I. Presentation of a film—16 m.m. (in French). *Rev. neurol.*, 1956, **95**, 62-63.

BARUK, H. et al. Clinical study of the therapeutic effects of reserpine; comparison with effects of total extracts (in French). *Ann. med. Psychol.* (Paris), Apr. 1957, 704-708.

BARUK, H. et al. Study of the effect of reserpine on psychomotor initiation and major psychological and biological constants; comparison with total extracts (in French). *Ann. med. Psychol.* (Paris), Apr. 1957, 708-712.

BASCHIERI, L. et al. Hypotensive effect of reserpine; clinical and hemodynamic research (in Italian). *Progr. med.* (Napoli), 15 May 1955, **11**(9), 260-9.

BASU, D.P. et al. "Lucin-H" in anticoagulant therapy. A preliminary report. *Indian J. Pharm.*, 1956, **18**(7), 315-16.

BAUMBERGER, W. Experience with the *Rauwolfia* alkaloid reserpine (Serpasil) in chronic mental disorders (in German). *Praxis*, 11 Aug. 1955, **44**(32), 721-4.

BAUMGRARDT, J.P. et al. Effect of dehydrated plant juice supplemented diet on the *in vitro* response of rat tissue slices to *Rauwolfia* alkaloid. *J. Pharmacol.*, Jan. 1957, **11**(2), 132 (abstract).

BAYER, J. Determination of crystalline reserpine in anhydrous medium (in Hungarian). *Magyar chem. Foly*, 1956, **62**(10), 355-356.

BAYREUTHER, H. The significance of reserpine-induced Parkinsonism for the treatment of schizophrenia (in German). *Arch. Psychiat.* (Berlin), 1958, **197**(2), 215-222.

BEAN, J.W. Reserpine, chlorpromazine, and hypothalamus in reaction to oxygen at high pressure. *Amer. J. Physiol.*, 1956, **187**, 389-394.

BECK, L. Treatment of late gestosis with hypotensive drugs (in German). *Geburtsch. u. Frauenheilk.*, Nov. 1957, **17**(11), 1010-1023.

BECK, T.A. Clinical experience with a sustained-release preparation of reserpine. *Internat. Rec. Med.*, 1955, **168**(12), 807-11.

BEHAR, I. and RIOPELLE, A.J. The effects of reserpine on the acquisition of the conditioned avoidance response. *J. abnorm. Social Psychol.*, Mar. 1957, **54**(2), 160-162.

BEIKIN, MORRIS and HARDY, WALTER G. Effect of reserpine and chlorpromazine on Sarcoma 37. *Science*, 8 Feb. 1957, **125**, 233-34.

BEIN, H.J. Pharmacology of *Rauwolfia*. *Pharmacol. Rev.*, 1956, **8**, 435-483.

BEIN, H.J. Pharmacology of reserpine; a new alkaloid from *R. serpentina*, Benth. (in German). *Experientia*, 15 Mar. 1953, **9**(3), 107-10.

BEIN, H.J. Significance of selected central mechanisms for the analysis of the action of reserpine. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 4-16.

BEIN, H.J. et al. Experimental studies on serpasil (reserpine) a new and very effective *Rauwolfia* alkaloid with analeptic effect (in German). *Schweiz. med. Wschr.*, 17 Oct. 1953, **83**(42), 1007-12.

BELEY, A. et al. Complications of high doses of reserpine for the disturbed retarded child; indication for doses (in French). *Encephale*, 1956, **45**(4), 802-807.

BELISLE, J.A. Evaluation of chlorpromazine and reserpine in intensive treatment of chronic psychotic patients. *J. Mich. med. Soc.*, July 1957, **56**(7), 859-862.

BELL, J.P. Magic drugs in psychiatry. *J. Kentuky St. med. Ass.*, 1954, **52**(10), 788-9.

BELLIS, E. and PALMIERI, L. Reserpine with chopromazine in the treatment of arterial hypertension (in Italian). *Rif. med.*, 22 Feb. 1958, **72**(8), 204-207.

BELLO, C.T. and TURNER, L.W. Effects of orally administered "Veriloid" and "Rauwiloid" on the blood pressure of hypertensive individuals. *Clin. Res. Proc.*, 1954, **2**, 70.

BELLUCCI, G. and CRISI, L. Application of an alkaloid of *R. serpentina*, Benth. to the technic of controlled hypertension (in Italian). *Atti Dell Accad Fisiocriici Siena: Sezione Med.-Fiseca*, 1954, **1**, xxxliii-xli.

BELLUCCI, G. et al. Cardiovascular surgery in hypothermia obtained by rapid refrigeration and the administration of a new alkaloid of *R. serpentina*, Benth. (in Italian). *Boll. Soc. ital. Biol. pser.*, 1954, **30**(7), 775-6.

BELSASSO, M. Treatment of mental disorders with high-dosage reserpine (Serpasil) and chlorpromazine (largactil) (in Italian). *Rass. giuiliana med.* (Trieste), July 1956, **12**(7), 209-216.

BELTRAMI, L. Pharmacological research on various species of *Rauwolfia* (in Italian). *Arch. ital. Sci. farmacol.*, Jan. 1957, **7**(1), 73-81.

BENDA, C.E. The differentiation between mental deficiency and emotional disorders, and some therapeutic experiments with *R. serpentina* (Koglucoid). *Arch. Pediat Urug.*, 1955, **26**(1), 32-46.

BENDITT, E.P. and WONG, R.L. Concentration of 5-hydroxytryptamine in mammalian enterochromaffin cells and its release by reserpine. *J. esp. Med.*, 1957, **105**, 509-520.

BENSON, G.K. Effect of reserpine on mammary gland involution and other organs in the rat. *Proc. Soc. expt. Biol.* (N.Y.), 1958, **99**, 550.

BENSTZ, W. Pathogenesis and therapy of hypertension (in German). *Medizinische*, 13 July 1957, No. 27-28, 1005-1007 (including treatment with reserpine).

BERKOWITZ, D. The effect of prolonged administration of *Rauwolfia serpentina* (Raudixin) on gastric acidity. *Amer. J. med. Sci.*, June 1958, **235**(6), 657-659.

BERNSMEYER, A. et al. Cerebral blood flow during the treatment of hypertension with reserpine (in German). *Klin. wschr.*, 1957, **35**, 631-634.

BERNSOHN, J. et al. Action of chloprozamine and reserpine on brain enzyme systems. *J. Neurochem.*, 1956, **1**, 145-149.

BERNSTEIN, S. Serial observations on the physiological and psychological changes in patients reacting with depression to reserpine. *J. Mt. Sinai Hosp.*, Mar.-Apr. 1957, **24**(2), 89-96.

BERNSTEIN, C. and KLOTZ, S.D. Allergenicity of tranquillizing drugs. *J. Amer. med. Ass.*, 16 Mar. 1957, **163**(11), 930-933.

BERTELLI, A. Effects of some hypotensive drugs on adrenal ascorbic acid in rats after adrenalin stimulation (in Italian). *Boll. Soc. ital. Biol. sper.*, July-Aug. 1956, **32**(7-8), 824-825.

BERTELLI, A. The increase of the antidiuretic effect of reserpine in animals with liver damage. *Boll. Soc. ital. Biol. sper.*, July-Aug. 1956, **32** (7-8), 829-832.

BERTELLI, A. and TUSINI, G. Antithyrotropic and antithyroxin activity of *Rauwolfia;* experimental bases for preparation of surgical therapy of hyperthyroidism (in Italian). *Biol. latina* (Milan), Jan.-Mar. 1956, **9** (1), 145-55.

BERTELLI, A. et al. Antipermeability effect of reserpine. *Biol. Soc. ital. Biol. sper.*, July-Aug. 1956, **32**(7-8), 832-835.

BERTELLI, A. et al. Variations of the content of serotonin in various organs after repeated administration of reserpine (in Italian). *Boll.*

Soc. ital. Biol. sper., July-Aug. 1956, **32**(7-8), 822-824

BERTHIAUME, M. Therapeutic advances in neuropsychiatry: reserpine (Serpasil) (in French). *Un. med. Can.*, Sept. 1956, **85**(9), 1039-1042.

BERTLER, A. et al. Release of catechol amines from rabbit's heart by reserpine. *Naturwissenschaften*, 1956, **43**, 521.

BESENDORF, H. and PLETSCHER, A. The influence of isopropylisonicotinylhydrazine and isonicotinylhydrazine on central actions of reserpine and 5-hydroxytryptamine (in German). *Helv. physiol. acta*, 1956, **14**(4), 383-390.

BEVAN, W. and CHINN, R.M. Sound-induced convulsions in rats treated with reserpine. *J. comp. physiol. Psychol.*, June 1957, **50**(3), 311-314.

BHARGAVA, K.P. Neuropharmacological study of *Rauwolfia* alkaloids on vasoregulatory mechanism. (Michigan Univ., Dissertation, 1957). *Dissert. Abtr.*, 1957, **17**, 867-868.

BHARGAVA, K.P. and BORISON, H.L. Comparative effects of various *Rauwolfia* alkaloids on centrally evoked vassopressor responses. *J. Pharmacol.*, 1957, **119**, 395-405; *Fed. Proc.*, 1956, **15**, 401 (abstract).

BHARGAVA, K.P. and BORISON, H.L. Effects of *Rauwolfia* alkaloids on hypothalamic, medullary and spinal vasoregulatory systems. *J. Pharmacol.*, Dec. 1955, **115**(4), 464-79.

BHATIA, B.B. On the use of *R. serpentina* in high blood pressure. *J. Indian med. Ass.*, 1942, **2**, 262.

BHATIA, B.B. and KAPUR, R.D. Pharmacological action of alkaloids of *R. serpentina* Benth. I. Neo-ajmaline and iso-ajmaline. *Indian J. med. Res.*, 1944, **32**, 177-82.

BHATTACHARYA, B.K. and LEWIS, G.P. Reserpine and compound 48/80 on the release of amines from the mast cells of rats. *Brit. J. Pharmacol.*, 1956, **11**, 411-416.

BIANCHESSI, M. Mecamylamin combined with reserpine in therapy of arterial hypertension (in Italian). *Rass. Fisiopat. clin. terap.*, Dec. 1957, **29**(12), 1428-1433.

BIANCHI, C. Anticonvulsant action of some antiepileptic drugs in mice pre-treated with *Rauwolfia* alkaloids. *J. Pharm.* (Lond.), 1956, **8**, 141-146.

BIANCHI, C. Calming activity of central nervous system depressants (in Italian). *Arch. int. Pharmacodyn.*, 1957, **111**, 227-238.

BIANCHI, C. Potentiation of experimental camphor, cardiazol and strychnine convulsions following administration of reserpine or whole *R. serpentina* alkaloids (in Italian). *Farmaco: Edizione Scientifica* (Pavia), 1955, **10**(10), 775-8.

BIANCHI, C. Reserpine and serotonin in experimental convulsion. *Nature*, 26 Jan. 1957, **179**, 202-203.

BIANCHI, C. Variations in coronary flow and the degree of contractions induced in the isolated mammalian heart by aminophylline, reserpine and whole *Rauwolfia serpentina* alkaloids (in Italian). *Farmaco: Edizione Scientifica* (Pavia), 1955, **10**(10), 779-82.

BIANCHI, A. and DE MAIO, M. Experimental study of potentiations of 21-hydroxypregnandione narcosis by serotonin, reserpine and hexamethonium (in Italian). *Gior. ital. chir.*, Mar. 1958, **14**(3), 280-289.

BIASCI, L. and RONCO, P. Modifications of the arterial oscillographic curve in mental patients after administration of various pharmacological stimulants, chlorpromazine; *Rauwolfia* alkaloids; barbiturate (in Italian). *Rass. Studi. Psichiat.*, Sept.-Oct. 1955, **44**(5), 606-24.

BILECKI, G. et al. *Rauwolfia serpentina*. I. Comparative investigations on the effects of reserpine and serpentine. *Z. Ges. univ. Med.*, 1955, **10** (23-24), 1097-1104.

BILY, D. Occupational problems of remission in schizophrenics treated with autonomic drugs. (in Czech.). *Ces. Psychiat.*, Dec. 1957, **53**(6), 377-381.

BISIO, B. Behaviour of cerebrospinal fluid (CSF) biological constants in reserpine-treated schizophrenic patients. *Neuropsichiatria*, 1956, **12**, 515-530.

BISIO, B. Behaviour of some blood values in reserpine-treated mental patients. *Cervello*, 1957, **33**, 21-40.

BLACKMAN, L.H. et al. Use of vitarrespital in the treatment of aged psychotic patients (in Spanish). *Arch. Med.* (Cuba), July-Nov. 1956, **7**(4), 191-194.

BLACKMAN, L.H. et al. The use of vitarrespital in the treatment of elderly psychotic patients. *Internat. Rec. Med.*, Jan. 1958, **171**(1), 46-51.

BLANCO QUINTANA, R. and MIER PONTE, M. Clinical use of pentapyrrolidinium (M. & H. 2050A) combined with *R. serpentina* in the treatment of arterial hypertension (in Spanish). *Rev. med. cubana* (Havana), 1955, **66**(10), 741-9.

BLEULER, M. The mechanism of serpasil treatment in schizophrenia (in German). *Schweiz. med. Wschr.*, 7 May 1955, **85**(19), 443-4.

BLEULER, M. and STOLL, W.A. Clinical use of reserpine in psychiatry: comparison with chlorpromazine. *Ann. N.Y. Acad. Sci.*, Apr. 1955, **61**(1), 167-73.

BOCCITTO, G. and BISETTI, A. Remote results of treatment of the arterial hypertensive syndrome with reserpine (in Italian). *Gazz. med. ital.*, Sept. 1956, **115**(9), 280-285.

BOCK, K.D. and MULLER, H. The effect of reserpine on skin and muscle circulation in normal and hypertensive subjects (in German). *Klin. Wschr.*, 15 Mar. 1956, **34** (11-12), 318-23.

BOER, S. DE. Effect of rauwolfine on the heart. *Cardiologia*, 1937, **1**, 1-8.

BOGICEVIC, D.J. Use of reserpine in psychiatry. (in Serbo-Croatian). *Srpski Arch.*, Apr. 1957, **85**(4), 440-455.

BOGICEVIC, D.J. et al. Personal experience and preliminary results in serpasil treatment of schizophrenia (in Serbo-Croatian). *Srpski Arch.*, Mar. 1957, **85**(3), 283-292.

BOHNER, E. and THEOBALD, H. Medicamentous treatment of hypertension with a *Rauwolfia* phthalazin combination compound (adelphan); preliminary report (in German). *Dtsch. med. Wschr.*, 17 June 1955, **80**(24), 929-30.

BOINES, G.J. Problem of emotional stress in hypertension. *Delaware St. Med. J.*, May 1957, **29** (5), 116-118.

BOM, F. et al. Effects of reserpine on the autonomic nervous system (in Danish). *Ugestker. Laeg.*, 1956, **118**, 329-333.

BONA, E. and LOVEI, E. The treatment of hypertension with hexamethonium bromide and *Rauwolfia* preparations (in German). *Ztg. Gesamte Innere Medizin Ihre Grenzgebiete*, 1 Oct. 1955, **10**(19), 924-31.

BONATI, F. Clinical experiments on the use of hypotensive phthalazine derivatives and on their association with *R. serpentina* (in Italian). *Gior. clin. Med.* (Parma), 1955, **36**(2), 149-64.

BONGAERTS, C. Trial of combination of doridenserpasil in different states of psychomotor excitation (in French). *Acta. neur. belg.*, Aug. 1957, **57**(8), 667-672.

BONNYCASTLE, D.D. et al. Alternations in rat brain 5-hydroxytryptamine levels of antiepileptic drugs. *Fed. Proc.*, Mar. 1957, **16**, 284 (abstract; includes reserpine).

BORDELEAU, J. M. Clinical evaluation of chlorpromazine and *R. serpentina* in the psychiatric department of a general hospital. *J. Fla. med. Ass.*, Jan. 1956, **42**(7), 547-54.

BORSARI, S. and BOCHI, S. *R. serpentina* Benth. alkaloid (reserpine) in therapy of arterial hypertension (in Italian). *Minerva med.* (Torino), 8 Dec. 1954, **45**, 1521-5.

BOSCOTT, R.J. et al. Reserpine therapy on adrenocortical function in schizophrenia. *Experientia*, 1956, **12**, 271.

BOSE, B.C. and VIJAYAVARGIYA, R. Observations on the depressant action of *Rauwolfia* alkaloids on the tissue respiration in rats. *Curr. Sci.*, Dec. 1957, **26**(12), 383-385.

BOSE, B.C. AND VIJAYAVARGIYA, R. Studies on the effects of *Rauwolfia* alkaloids on the succinic dehydrogenase enzyme activity in brain and liver tissues of albino rats. *Indian J. med. Sci.*, 1958, **12**, 440-44.

BOSE, S.N. Haematemesis following operation for another condition with preoperative *Rauwolfia* therapy. *Calcutta med. J.*, 1958, **55**, 179-82.

BOWER, H.M. A clinical evaluation of reserpine in the treatment of chronic mental patients. *Med. J. Aust.*, 16 July 1955, 42, **2**(3), 82-6.

BOWER, H.M. Reserpine: some theoretical and practical aspects of the problem. *Med. J. Aust.*, **44**, 2 Mar. 1957, **1**(9), 268-273.

BRACHA, S. and HES, J.P. Death occurring during combined reserpine-electro-shock treatment. *Amer. J. Psychiat.*, Sept. 1956, **113**(3), 257.

BRADLEY, P.B. and JEAVONS, P.M. The effect of chlorpromazine and reserpine on sedation and convulsive thresholds in schizophrenic patients. *Electroencep. clin. Neurophysiol.*, Nov. 1957, **9**(4), 661-672.

BRANDER, E. Effects of tranquillizing drugs (reserpine, chlorpromazine) on extraphyramidal motibility disorders (in German). *Mschr. Psychiat Neurol.*, Aug.-Sept. 1956, **132**(2-3), 81-95.

BRAUN, H.A. and LUSKY, L.M. Comparative study of pigeon emetic methods and proposed chemical methods for assay of *Rauwolfia*. *Fed. Proc.*, Mar. 1957, **16**, 285 (abstract).

BRAUN, V. Effects of whole *Rauwolfia* alkaloids and of the purified alkaloid, reserpine, in angina pectoris (in German). *Med. Klinik.* (Berlin), 5 Apr. 1957, **52**(14), 552-553.

BRAUNER, R. et al. Notes on neurolytic drugs in therapy of arterial hypertension (in Rumanian). *Med. int.* (Bucuresti), Mar. 1958, **10**(3), 439-445 (includes reserpine).

BRILL, H. and PATTON, R.E. Hospital population trend and drug therapy. *Publ.Hlth.Rep.* (Wash.), July 1957, **72**, 629-632.

BROD, J. and FENGL, V. Renal hemodynamic and function during the treatment of hypertension with an extract from *R. serpentina*, Rivadescine. (in Czech.). *Vnitrni Lekarstvi* (Bruno), July 1955, **1**(7), 539-44.

BROD, J. and FENGL, V. Therapy of hypertension with drugs made of *R. serpentina* (in Czech). *Cas. Lek. ces.* (Praha), 4 Mar. 1955, **94**(10), 240-4.

BROD, J. and HEJL, Z. Hemodynamic changes caused by hypotensive effect of *Rauwolfia serpentina* (in Czech). *Cas. lek cesk.*, 6 Sept. 1957, **96**(36), 1129-1134.

BRODIE, B.B. et al. Evidence that serotonin has a role in brain function. *Science*, 18 Nov. 1955, **122**, 968 (reserpine on liberation of serotonin from brain).

BRODIE, B.B. et al. Mechanism of action of reserpine; effect of reserpine on capacity of tissues to bend serotonin. *J. Pharmacol.*, 1957, **119**, 461-467.

BRODIE, B.B. et al. Possible inter-relation between release of brain morepinephrine and serotonin by reserpine. *Science*, 1957, **125**, 1293-1294.

BRODIE, B.B. et al. Potentiating action of chlorpromazine and reserpine. *Nature*, 25 June 1955, **175**, 1133-4.

BRODIE, B.B. Rapid biosynthesis of brain serotonin before and after reserpine administration. *Naturwissenschaften*, 1958, **45**, 243-244.

BRODIE, B.B. et al. *Rauwolfia* alkaloids with tranquillizing action. *J. Pharm.* (Lond.), Apr. 1957. **9**(4), 263.

BRODIE, B.B. et al. Serotonin releasing activity limited to *Rauwolfia* alkaloids with tranquillizing action. *Science*, June 1956, **123**, 992-93.

BROOKS, C. The use of reserpine (Serpasil) in mentally ill epileptics. Pt. I. *Dis. nerv. Syst.*, July 1957, **18**(7), 275-276.

BROOKS, G.W. Experience with the use of chlorpromazine and reserpine in psychiatry with special reference to the significance and management of extrapyramidal dysfunction. *New Engl. J. Med.*, 14 June 1956, **254**, 1119-1123.

BROSS, R.B. Near fatality with combined ECT and reserpine. *Amer. J. Psychiat.*, Apr. 1957, **113**(10), 933.

BROWN, B.B. Lysergric acid and diethylamide antagonism of certain drugs. *Ann. N.Y. Acad. Sci.*, 14 Mar. 1957, **66**(3), 677-685 (includes reserpine)

BROWNE, J. Parkinsonism as a result of treatment with reserpine. Report of a case. *Med. J. Malaya*, 1956, **10**, 262-63.

BRUSA, A. et al. Additional results and findings concerning the use of reserpine treatment in psychoses (in Italian). *Sist. nerv.*, July-Aug. 1957, **9**(4), 236-252.

BRUSCHA, W. Changes of the leukocyte formula with massive doses of serpasil (in German). *Klin. Wschr.*, 1 July 1955, **33**(25-26), 624-5.

BRUSCHA, W. Humoral changes due to autonomic drug therapy (in German). *Arch. Psychiat.* (Berlin), 1957, **196**(1), 90-98.

BRYANT, J. H. et al. Drug therapy; a survey of the literature. Baton Rouge, La., 1956, 24 pp. (including ref. to reserpine).

BUCHS, P. Serpasil, a new hypotensive drug (in French). *Praxis*, 3 June 1954, **43**(22), 480-3.

BUCHEL, L. and LEVY, J. Study of the potentialisation of hypnotics by reserpine (in French). *J. Physiol.* (Paris), Mar. 1958, **50** (2), 195-199.

BUDNICK, I. S. et al. Effect in the new-born infant of reserpine administered ante partum. *Amer. J. Dis. Child.*, Sept. 1955, **90**(3), 286-9.

BUHR, G. Influence of *Rauwolfia* alkaloid-reserpine on blood circulation, respiration and total metabolism in men (in German). *Z. kreisl Forsch.*, Aug. 1957, **46**(15-16), 606-611.

BUKOWCZYK, A. Two year observation on the treatment of mental disease with chlorpromazine in meningitis in children (in Polish). *Polski tygod. lek.*, 16 Sept. 1957, **12**(38), 1448-1451 (includes reserpine).

BUKOWCZYK, A. and WIERZBICKI, T. Treatment of schizophrenia with reserpine (in Polish). *Neurol Sc. Polska*, Sept.-Oct. 1957, **7**(5), 701-705.

BULIC, F. *Rauwolfia serpentina*, Benth. in the treatment of arterial hypertension (in Bulgarian). *Srpski Arch. tselok. Lek.*, 1954, **82**(10), 1270-3.

BULIC, F. and NAJDANOVIC, B. First results of reserpine (Serpasil) therapy of hypertension (in Bulgarian). *Med. Glasn.*, 1955, **9**(1), 27-9.

BULLE, P.H. Chlorpromazine and reserpine prevention of synocardial damage by histamine and serotonin. *Science*, 1957, **125**(3262), 24-26.

BULLE, P.H. Effects of reserpine and chlorpromazine in prevention of cerebral oedema and reversible cell damage. *Proc. Soc. exp. Biol.* (N.Y.), 1957, **94**, 553-556.

BUNN, W.H. Clinical report on the effect of *Rauwolfia* and other hypotensive drugs. *Ohio St. med. J.*, 1955, **51**(2), 126-9.

BURGER, M. Changes in the adrenalin and noradranalin concentration of human blood plasma during ethernarcosis (in German). *Arch. exp. Path. Pharmak.*, 1957, **230**(5), 489-498.

BURGER, M. Decrease of noradrenaline concentration in plasma after reserpine (in German). *Helv. physiol. acta*, 1956, **14C**, 13-14.

BURN, J.H. and RAND, J.M. Effect of reserpine vasoconstriction caused by sympathomimetic amines. *Lancet*, 29 Mar. 1958, **1**(7022), 673.

BURN, J.H. and RAND, M. J. Noradrenaline in artery walls and its dispersal by reserpine. *Brit. med. J.*, 19 Apr. 1958, No. 5076, 903-908.

BURN, J.H. and RAND, M. J. Reserpine and noradrenaline in artery walls. *Lancet*, 1957, **II**, 1097.

BURN, J.H. and RONEEN, HOBBS. A test for tranquillizing drugs. *Arch. int. Pharmacodyn.*, 1958, **113**, 290-295.

BURNELL, R.H. Reserpine depression treated with sodium succinate; a preliminary report. *N.Z. med. J.*, Oct. 1955, **54**, 565-7.

BURRELL, R.H. Depression associated with reserpine therapy. *N.Z. med. J.*, June 1956, **55**, 228-231.

BURNETT, C.F. and EVANS, J.A. Drug therapy in hypertension with hemorrhagic hypertensive retinitis. *New Engl. J. Med.*, 8 Sept. 1955, **253**(10), 395-8.

BURTON, R.M. The analeptic action of lysergic acid diethylamide on reserpine-sedated mice. *Ann. N.Y. Acad. Sci.*, 14 Mar. 1957, **66**(3), 695-697.

BURTON, R.M. et al. Effect of reserpine and promazine on diphosphopridine nucleotide synthesis in liver. *Science*, 1958, **127**(3288), 30-32.

BUSCAINO, A.G. and DEDE, G. Our experience of reserpine, cases treated and its mode of action. *Acta neurol.* (Napoli), 1957, **12**(2), 43-79.

BUSSOLATI, C. Effect of reserpine on chronic malilignant hypertension (in Italian). *Gazz. med. ital.* (Torino), 1954, **113**(10), 318-20.

BUSSOW, H. and LIDNER, W. Reverse action of "Doriden" (α-phenyl-α-ethylglutaric acid imide-(CIBA) in the course of reserpine treatment of depression (in German). *Med. Wschr.*, 1958, **83**(13), 500-501.

BUSSOW, J. and FUHR, J. Treatment with a combined reserpine-doriden preparation, studies on the serotonin metabolism (in German). *Nervenarzt*, 20 June 1958, **29**(6), 268-269.

BUTTON, J.C. Meratran with reserpine; adjunctive use in the treatment of Parkinson's disease. *J. Amer. osteop. Ass.*, Apr. 1956, **55**(8), 501-2.

CABALEIRO-GOAS, M. Comparing results of treatment with chlorpromazine, reserpine, and azacyclonol in paranoid schizophrenics (in Spanish). *Acta. Luso-esp. Neurol.*, 1958, **17**(1), 1-5.

CACCIALANZA, P. Antipruriginous action of an alkaloid of *R. serpentina* (in Italian). *G. ital. Derm. Sif.*, 1955, **96**(1), 82-7.

CACHIN, M. and PERGOLA, F. Reserpine in the treatment of delirium tremens (in French). *Sem. Hop.* (Paris), 14 Dec. 1957, **33**(71), 4171-4176.

CAIRO, A.A. *Rauwolfia serpentina. Bull. Georgetown Univ. med. Centre*, Nov. 1956, **10**(2), 42-45.

CALCUTTA SCHOOL OF TROPICAL MEDCINE. Annual report of the Calcutta School of Tropical Medicine and the Carmichael Hospital for Tropical Diseases. Alipore, Govt. Press. (from 1933 onwards. Under reports of the Professor of Pharmacology).

CALLINGHAM, B. A. and MANN, MONICA. Adrenaline and noradrenaline content of the adrenal gland of the rat following depletion with reserpine. (Lett.). *Nature*, 8 Feb. 1958, **181**(4606), 423-24.

CALLINGHAM, B.A. and MANN, MONICA. Replacement of adrenaline and noradrenaline in the innervated and denervated adrenal gland of the rat, following depletion with reserpine. (Lett.). *Nature*, 11 Oct. 1958, **182**(4641), 1020-21.

CALLOWAY, N.O. Tranquilization and sedation by the use of combination of small doses of reserpine and pentabarbital sodium. *Illinois med. J.*, Nov. 1956, **110**(5), 232-234.

CALMA, C.R. and TRINIDAD, J.C. *Rauwolfia serpentina* as an adjunct in the preoperative management of toxic goiter. *Philipp. J. Surg.*, 1958, **13**, 369- 377.

CAMANNI, F. et al. Selective depletion of noradrenaline in the adrenal medulla of the rat after administration of reserpine (Histochemical Research). *Experientia*, June 1958, **14**(6), 199-201.

CAMPDEN-MAIN, B.C. and WEGIELSKI, Z. The control of deviant behaviour in chronically disturbed psychotic patients by the oral administration of reserpine. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 117-22.

CAMPIONI, T. and FOIS, M. Early results of largactil and serpasil therapy of a group of mentally handicapped children with abnormalities of characters (in Italian). *Rass Studi. psichiat.*, 1956, **45**(5), 970-972.

CANARY, J.J. et al. Effects of oral and intramuscular administration of reserpine in thyrotoxicosis. *New Engl. J. Med.*, 1957, **257**, 435-442.

CANNADY, E.W. Combined drug therapy in hypertension. *Illinois med. J.*, 1955, **107**(4), 163-7.

CAPACCI, A. and BORDOLI, L. *Rauwolfia serpentina* combined with methonium salts in the treatment of arterial hypertension (in Italian). *Minerva med.* (Torino), 17 Nov. 1956, **47**(92), 1614-1616.

CAPACCI, A. and BORDOLI, L. *Rauwolfia serpentina* in the treatment of arterial hypertension (in Italian). *Minerva med.* (Roma), 6 June 1955, **46**(45), 1647-51.

CAPUTI, A. Reserpine in arterial and supraneutricular tachycardia. *R. I. med. J.*, Nov. 1956, **39** (11), 690.

CARBONELL-AGUILAR, C. Chlorpromazine, *Rauwolfia serpentina* in the treatment of chronic arterial hypertension. *Rev. cubana Cardiol.*, Apr.-June 1956, **17**(2), 80-84.

CAREY, E.F. A new approach to the emergency treatment of sickness caused by narcotic withdrawal. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 222-9.

CARGNELLO, D. Reserpine therapy of chronic schizophrenia (in French). *Encephale*, 1956, **45**(4), 1056-1070.

CARLSSON, A. and HILLARP, N.A. Release of adrenaline from the adrenal medulla of rabbits produced by reserpine. *Kgl. fysiograf. Salsk. Lund. Forh.*, 1956, **26**(8), 90-91.

CARLSSON, A. et al. Release of serotonin, from blood platelets by reserpine, in vitro. *J. Pharmacol.*, 1957, **120**, 334-339.

CARLSSON, A. et al. 3,4-Dihydroxyphenylalanine and 5-hydroxytryptophan as reserpine antagonists. *Nature*, 30 Nov. 1957, **180**(4596), 1200.

CASELLI, G. and MARTELLI, G. Clinical and electroencephalographic findings during treatment of mental disorders with lithium salts (in Italian). *Gior. psichiat.*, 1958, **86**(1), 329-345 (includes reserpine).

CASTEX, M.R. Antiallergic effects of reserpine (in Spanish). *Prensa med. argent.*, 15 July 1955, **42**(28), 2091-2.

CASTIAU, J. Effects of reserpine on gastric motility in the dog (in French). *Arch. int. Pharmacodyn.*, 1 Apr. 1958, **114** (3-4), 478-479.

CATALANO, A. Hemiparkinsonism from reserpine. *Acta neurol.* (Napoli), 1956, **11**(2), 381-385.

CAULFIELD, R.A. *Rauwolfia* in the treatment of hypertension. *Practitioner*, Aug. 1955, **175**, 189-91,

CAVIER, R. and SAVEL, J. New medicines. *Prod. Pharm.*, Feb. 1958, **13**(2), 41-90. (Rauwolfia and its alkaloids, p. 84).

CAZZAROLI, L. and DALL'OGLIO, D. Effect of *Rauwolfia serpentina* on the glycemic curve of the glucose tolerance test in normal subject and diabetics (in Spanish). *Progr. med.* (Napoli), 31 Jan. 1958, **14**(2), 52-56.

CELLERINO, R.J. *Rauserfia*, new hypotensive drug; its injectable (intramascular) therapeutic use (in Spanish). *Sem. med.* (B. Aires), 16 May 1957, **110**(21), 687-691.

CENTURY, BERNARD and HORWITT, M.K. Actions of reserpine and chlorpromazine hydrochloride on rat brain oxidative phosphorylation and adenosinetriphosphate, *Proc. Soc. exp. Biol.* (N.Y.), Jan. 1956, **91**(1), 493-497.

CHAKRAVARTI, M.D. Indian medicinal plants in the treatment of hypertension. *Brit. med. J.*, 1953, 1390 (incl. *Rauwolfia serpentina*).

CHAKRAVARTI, M.D. Note on the pharmacological action of rauwolscine. *Sci. & Cult.*, 1942, **7**, 458.

CHAKRAVARTI, M.D. Premilinary note on the adrenolytic effects of a few *Rauwolfia* alkaloids, including that of *R. canescens*. *Indian J. Pharm.*, 1956, **18**(7), 303-06.

CHAKRAVARTI, M.D. Some observations on the toxicity of *Rauwolfia* preparations as sold in the market for the treatment of hypertension. *J. Indian med. Ass.*, Jan. 1954, **23**(4), 147-50.

CHAKRAVARTY, N.K. et al. Pharmacological study of *R. serpentina*. *Bull. Calcutta Sch. trop. Med.*, 1954, **2**(1).

CHAKRAVARTY, N.K. et al. *Rauwolfia serpentina* in essential hypertension. *Indian med. Gaz.*, **86**(8), 1951, 348-54.

CHAKRAVARTY, N.K. et al. Vasodilation in the kidney following injection of *Rauwolfia serpentina*. *Bull. Calcutta Sch. trop. Med.*, 1954, **2**(1), 1-2.

CHAKRAVARTI, R.N. and DAS GUPTA, B. Some observations on *Rauwolfia serpentina* roots. *Bull. Calcutta Sch. trop. Med.*, 1954, **2**(1), 14-15.

CHAN, C.H. Complication during reserpine therapy. *Amer. J. Psychiat.*, July 1955, **112**(1), 64.

CHANDLER, J.H. Reserpine in the treatment of Huntington's chorea. *Univ. Mich. Med. Bull.*, 1955, **21**(4), 95-100.

CHARLIN, A. Respective actions of chlorpromazine and reserpine; pathogenic hypotheses (in French). *Encephale*, 1956, **45**(4), 1099-1105.

CHART, J.J. et al. Adrenal regeneration hypertension: Drug effects. *Fed. Proc.*, Mar. 1957, **16**, 22. (Abstract: incl. reserpine).

CHATTERJEE, Asima et al. Central and peripheral actions of two yohimbine isomers (Serpine and Rauwolscine). *Indian J. med. Res.*, 1954, **42**(4), 613-7.

CHATTERJEE, M.L. Effect of *Rauwolfia serpentina* on striated muscle. *Bull. Calcutta Sch. trop. Med.*, 1955, **3**, 159-160.

CHATTERJEE, M.L. Pharmacological action of *Rauwolfia serpentina*, Benth. and its effect on the action of adrenaline and of acetylcholine on isolated auricles of heart and on isolated duodenum of rabbit. *Indian Pharm.*, 1956, **18**(6), 250-58.

CHATTERJEE, M.L. and DE, M.S. Effect of *Rauwolfia serpentina* on the action of adrenaline on the perfused isolated heart of toad (*Bufo melanostictus*). *Bull. Calcutta Sch. trop. Med.*, 1956, **4**, 124-125.

CHATTERJEE, M.L. and DE, M.S. Some observations on the action of ajmaline on isolated guinea pig ileum and its interaction with a few spasmogenic agents. *Bull. Calcutta Sch. trop. Med.*, 1957, **5**(4), 173.

CHATTERJEE, M.L. and HAUSLER, H.F. Anti-acetylcholine and anti-histamine actions of the total alkaloids of *R. serpentina*, Benth. *Nature*, 8 Oct. 1955, **176**, 701; (also in *Bull. Calcutta Sch. trop. Med.*, 1955, **3**, 70.)

CHATTERJEE, M.L. and HAUSLER, H.F. Antinicotinic action of *Rauwolfia serpentina* on the blood pressure of atropinised cat and its comparison with the antiadrenaline property. *Bull. Calcutta Sch. trop. Med.*, 1955, **3**, 158-59.

CHATTERJEE, M.L. and HAUSLER, H.F. Preipheral anti-effect of *R. serpentina*, Benth. (in German). *Arch. Path. exp. Pharmak.*, 1956, **228**(1-2), 171.

CHATTERJEE, M.L. et al. Pharmacological studies on a fraction of *Rauwolfia serpentina* alkaloids isolated by counter-current distribution technique. *Bull. Calcutta Sch. trop. Med.*, 1957, **5**, 21-22.

CHATTERJEE, M.L. et al. Preliminary observations on the effect of total alkaloids of *Rauwolfia serpentina* and reserpine on blood sugar in cats. *Bull. Calcutta Sch. trop. Med.*, 1957, **5**(4), 172.

CHATTERJEE, R.N. et al. Preliminary report on hypotensive effect of reserpine. *J. Indian med. Ass.*, 1956, **27**, 167-73.

CHATTERJI, K.K. Hypertension and its combination therapy with *Rauwolfia*. *Indian J. Pharm.*, 1956, **18**(8), 342-44.

CHEN, G. and BOHNER, B. A study of the neuropharmacologic properties of certain convulsants, anticonvulsants and reserpine. *J. Pharmacol.*, June 1956, **117**(2), 142-7.

CHEN, G. and ENSOR, C.R. Antagonism studies on reserpine and certain CNS depressants. *Proc. Soc. exp. Biol.*, Dec. 1954, **87**(3), 602-8.

CHEN, G. et al. A facilitation action of reserpine on the central nervous system. *Proc. Soc. exp. Biol.*, July 1954, **86**(3), 507-10.

CHERTOK, L. Use of neuroleptic drugs in the treatment of psychoneuroses (in French). *Encephale*, 1956, **45**(4), 705-786 (includes reserpine).

CHESSIN, M. et al. Modification of the pharmacology of reserpine and serotonin by iproniazid. *J. Pharmacol.*, 1957, **119**, 453-460.

CHOPRA, R.N. and CHAKRAVARTI, M. A preliminary note on the pharmacological action of the alkaloids of *R. serpentina*. *Indian J. med. Res.*, Oct. 1941, **29**(4), 763-68.

CHOPRA, R.N. et al. Action of ajmaline on nerve impulses. *Indian. J. med. Res.*, Apr. 1937, **24**(4), 1125-30.

CHOPRA, R.N. et al. Alkaloids of *R. serpentina*, a comparative study of their pharmacological action and their role in experimental hypertension. *Indian. J. Med. Res.*, Apr. 1942, **30**(2), 319-24.

CHOPRA, R.N. et al. Hypnotic effect of *R. serpentina*, the principle underlying this action, its probable nature. *Indian J. med. Res.*, 1943, **31**, 71-74.

CHOPRA, R.N. et al. Pharmacological action of an alkaloid obtained from *R. serpentina*, Benth. A preliminary note. *Indian J. med. Res.*, Oct. 1933, **21**(2), 261-71.

CHOPRA, R.N. et al. Pharmacological action of ajmaline—an alkaloid occurring in *R. serpentina* N.O. Apocyanaceae. *Proc. Indian Sci. Congr.*, 1933, *Abst. Sec. Med.*, p. 382.

CHOWHAN, J.S. Anticonvulsant properties of reserpine (alkaloid from *R. serpentina*). Few experimental observations on rabbits. *Antiseptic*, 1956, **53**, 858-60.

CHOWHAN, J.S. Insanity herbs. (*Rauwolfia serpentina*, Benth.); pharmacology and therapeutic uses, particularly in mental aberrations. *Antiseptic*, Apr. 1942, **39**, 197-204.

CHRISTE, R. Comparative therapeutic effect of serpasil-ritalin combination (in French). *Schweiz. med. Wschr.*, 17 Nov. 1956, **86**(46), 1318-1321.

CHRISTIAN, H.H. et al. Comparative effects of chlorpromazine and reserpine on electroshock seizure threshold. *Fed. Proc.*, Mar. 1956, **15**, 410 (abstract).

CHRISTIAN, J.J. Reserpine suppression of density-dependent adrenal hypertrophy and reproduc-

tive hypoendocrinism in populations of male mice. *Amer. J. Physiol.*, Nov. 1956, **187**(2), 353-356.

CHRISTIAN, J.J. Reserpine suppression of murine adrenal and reproductive responses to population density. *Fed. Proc.*, Mar. 1956, **15**, 511 (abstract).

CHUSID, J.G. et al. Reserpine (Serpasil) effects on epileptic monkeys. *Proc. Soc. exp. Biol.* (N. Y.), Feb. 1955, **88**(2), 276-7.

CIGARDO, V.H. Pharmacological study of *R. serpentina* (in Spanish). *Prensa med. argent.* (B. Aires), 10 Sept. 1954, **41**(37), 2654-6.

CIESLAK, G. Psychiatric experience with reserpine (in German). *Medizinische*, 6 Apr. 1957, No. 14, 490-492.

CINELLI, V.A. Selected useful injectable *Rauwolfia* alkaloids in the therapy of arterial hypertension (in Spanish). *Sem. med.* (B. Aires), 3 Apr. 1958, **112**(14), 515-578.

CIULLA, U. New hypotensive drugs in prevention and therapy of late pregnancy toxemias (in Italian). *Minerva Ginec.*, 30 Apr. 1955, **7**(8), 70-2.

CIULLA, U. Reserpine in the treatment of hypertension in pregnancy (in Italian). *Ann. Ostet. Ginec.*, 1954, **76**(6), 591-613.

CLARK, M.D. and SCHNEIDER, E.M. The effect of intravenous reserpine on gastric acidity in man. *Gastroenterology*, Nov. 1955, **29**(5), 877-81.

CLOUGH, P.W. Reserpine in the treatment of neuropsychiatric disorders. *Ann. intern. Med.*, Sept. 1955, **43**(3), 632-7.

COAKLEY, C.S. et al. Circulatory responses during anesthesia of patients on *Rauwolfia* therapy. *J. Amer. med. Ass.*, 21 July 1956, **161**(12), 1143-4.

COAN, J.P. et al. Current therapy of hypertension. *J. S. C. med. Ass.*, 1955, **51**(12), 417-21.

COHEN, M.B. Cryptenamine and cryptenamine plus reserpine in the treatment of arterial hypertension. *Amer. Practit. Dig. Treatment.*, 1955, **6**(7), 1030-5.

COHEN, M.B. Cryptenamine plus reserpine in the office treatment of hypertension; preliminary observations in eleven patients. *J. med. Soc. N. J.*, 1955, **52**(7), 342-5.

COHEN, B.M. The management of moderately severe hypertension with cryptenamine and *Rauwolfia* ; observations in patients treated for up to two years. *Amer. J. Cardiol.*, June 1958, **1**(6), 748-756.

COHEN, B.M. *Rauwolfia* - barbiturate- xanthine mixtures in the treatment of hypertension. *Mil. Med.*, Feb. 1957, **120**(2), 102-106.

COHEN, S. Clinical experiences with pirpradrol and pirpradrol-reserpine combination. *Int. Rec. Med.*, Nov. 1956, **169**(11), 751-756.

COLEMAN, R.R. and MAGUIRE, W. *Rauwolfia serpentina* in hypertensive patients; preliminary report. *J. S. C. med. Ass.*, 1955, **51**(6), 201-5.

COLLIER, G. and DEFER, B. Various biological changes seen during reserpine therapy; hypothesis on potassium metabolism and various endocrine functions (in French). *Ann. med. psychol.* (Paris), May 1957, **115**, 901-911.

COLOMBATI, S. and BENASSI, P. Serpasil, an alkaloid of *Rauwolfia* in the treatment of epilepsy (in Italian). *Gazz. med. Ital.* (Torino), 1955, **114**(3), 69-72.

COLOMBATI, S. and BENASSI, P. Use of *Rauwolfia* alkaloids in neuropsychiatry (in Italian) *Gazz. med. Ital.* (Torino), **113**(10), 1954, pp. 301-3.

CONNER, P.K. et al. Use of pyrrobutamine in treatment of *Rauwolfia*-induced nasal congestion. *Geriatrics*, Mar. 1957, **12**(3), 185-189.

CONNOR, N.D. and HASS, K.B. Effects of reserpine in the dog. Preliminary report. *J. Amer. vet. med. Ass.*, Feb. 1955, **126**, 137-140.

CONSTABLE, KATE and DOSHAY, L.J. *Rauwolfia* compounds in the treatment of Parkinsonism. *J. Amer. med. Women's Ass.*, 1956, **11**, 165-168.

CONSTANTINESCU, C. et al. Serpasil treatment in chorea minor. *Rumanian med. Rev.*, Oct. Dec. 1957, **1**(4), 40.

CONWAY, G.F. et al. Relief of nasal stuffness by pyronil in patients receiving Sandril. *J. Indiana St. med. Ass.*, 1955, **48**(6), 603-4. (Reserpine causing nasal congestion).

COOPER, E.H. and CRANSTON, W.I. Comparison of the effects of phenobarbitone and reserpine in hypertension. *Lancet*, 1957, 396-397.

COPPOLA, F. Reserpine in private practice; use of reserpine in the treatment of mental disorders in familiar surroundings (in Italian). *Rass. Studi. psichiat.*, Sept.-Oct. 1957, **46**(5), 768-785.

CORCORAN, A.C. et al. Management of hypertensive disease. *Amer. J. Med.*, Sept. 1954, **17**(3), 383-94.

CORREALE, P. and CORTESE, I. Colorimetric determination of 5-hydroxytryptamine in the gastrointestinal tract of rats and chickens treated with reserpine (in Italian). *Boll. Soc. ital. Biol. sper.*, July-Aug. 1956, **32** (7-8), 525-527.

COSSIO, M. Relation of reserpine (Serpasil) to 5-hydroxytryptamine; preliminary note (in Italian). *Riv. sper. Freniat.*, 31 Dec. 1955, **79**(4), 865-7.

COSSUTTA, A. Recent trends in hypotensive therapy of eclampsia and the pre-eclamptic state; combined eclid-reserpine (in Italian). *Minerva gin.* (Torino), 31 Mar. 1958, **10**(6), 238-247.

COTTEN, H. B. et al. Effects of *Rauwolfia serpentina* in patients with hypertension. *Amer. J. med. Sci.*, 1955, **230**, 408-414.

COULLAUT-MENDI GUTA, R. and COLINA-LEONES, M.J. Current status of the treatment of schizophrenia with chlorpromazine and reserpine (in Spanish). *Rev. clin. esp.*, 15 Dec. 1956, **63** (5), 315-329.

COUPLAND, R.E. The effects of insulin, reserpine and choline 2:6-xylylether bromide on the adrenal medulla and on medullary autografts in the rat. *J. Endocr.*, July 1958, **17**(2), 191-196.

COUPLAND, R.E. Strain sensitivity of albino rats to reserpine. *Nature*, 29 Mar. 1958, **181**(4613), 930-931.

COWDEN, R.C. et al. Group psychotherapy in conjunction with a physical treatment. *J. clin. Psychol.*, 1956, **12**(1), 53-4.

COWDEN, R.C. et al. Reserpine alone and as an adjunct to psychotherapy in the treatment of schizophrenia. *Arch. Neurol. Psychiat.* (Chicago), Nov. 1955, **74**(5), 518-22.

CRAWLEY, C.J. et al. Appraisal of methium chloride with *Rauwolfia* in ambulatory hypertensive patients. *N.Y. St. J. Med.*, 1 Aug. 1954, **54**(15), 2205-7.

CRAWLEY, C.J. et al. Methium chloride with reserpine, a new antihypertensive combination. *N.Y. St. J. Med.*, 1 Dec. 1955, **55**(23), 3461-3.

CRECELIUS, W. Clinical experiences in drug therapy of hypertension (in German). *Arztl. Wschr.*, 14 Oct. 1955, **10**(41), 949-52.

CRONHEIM, G. and GOURZIS, J.T. Cardiovascular effects of serotonin in dogs premedicated with reserpine. *Fed Proc.*, Mar. 1956, **15**, 414 (abstract).

CRONHEIM, G. et al. Comparison of the sedative properties of single alkaloids of *Rauwolfia* and their mixtures. *J. Pharmacol.*, 1957, **119**, 357-360.

CRONHEIM, G. et al. Pharmacological studies with rescinnamine, a new alkaloid isolated from *R. serpentina*. *Proc. Soc. exp. Biol.* (N.Y.), May 1954, **86**(1), 120-4.

CUTLER, R.P. et al. Effects of tranquilizers upon pathological activity in psychotic patients. *Arch. Neurol. Psychiat.* (Chicago), July 1957, **78**(1), 61-68 (incl. reserpine).

CUZZONI, M.T. Method of determination of reserpine in a pharmaceutical preparation (in Italian). *Farmaco. ed. prat.* (Pavia), Feb. 1957, **12**(2), 76-82.

CUZZONI, M.T. Reserpine from the technical-pharmaceutical point of view (in Italian). *Farmaco. ed. prat.* (Pavia), Apr. 1957, **12**(4), 204-208.

DAESCHNER, C.W. et al. Parenteral administration of reserpine in the treatment of hypertension due to acute and chronic nephritis; clinical and renal hemodynamic studies. *Pediatrics*, Apr. 1957, Pt. I, **19**(4), 566-579.

DAHAN, E. Temperature regulating action of *Rauwolfia serpentina* in pulmonary tuberculosis (in French). *J. med. libanais*, Jan. 1957, **10**(1), 64-67.

DALE, P.W. The actions of reserpine. *Connec. St. med. J.*, 1955, **19**(8), 652-5.

DALESTRIERI, A. Chlorpromazine, reserpine and epileptic phenomena (in Italian). *Riv. neurol.* (Napoli), Nov.-Dec. 1956, **26**(6), 661-688.

DALLE-COSTE, P. and KLINGER, R. *Rauwolfia serpentina* extracts combined with hexamethonium in therapy of arterial hypertension in diabetics. (in Italian). *Minerva med.* (Torino), 24 Feb. 1957, **48**(16), 634-638.

DAMM, G. and TRAUTNER, H. Capillary microscope investigations of the action of *Rauwolfia* alkaloid reserpine (Serpasil) on the circulation in hypertension (in German). *Dtsch. med. Wschr.*, 1956, **81**, 1578-1580.

DAMM, G. and TRAUTNER, H. Therapy of arterial hypertension with reserpine (Serpasil) (in German). *Dtsch. med. wschr.*, 18 Dec. 1953, **87**(51), 39-41.

D'ARGENIO, L. and GIOVANELLI, G. Liver function tests in a group of mentally handicapped children treated with largactil and serpasil (in Italian). *Rass. Studi. psichiat.*, 1956, **45**(5), 1170-1171.

DAS, N. et al. Pentamethylene terazol induced seizure. *Calcutta med. J.*, Apr. 1958, **55**, 4. (Comparative action of reserpine and phenobarbital regarding the electrical activity of brain and behaviour changes in rabbits).

DAS, N.N. et al. Haemodynamic effects of Rauwolscine. *Indian J. med. Res.*, 1955, **43**, 101-6.

DAS GUPTA, S.J. Rauwolscine, the alkaloid of *R. canescens*. *Sci. & Cult.*, 1953, **19**, 44-45.

DAS GUPTA, S.R. and HALEY, T.J. Intraventricular administration of reserpine and its metabolites to conscious cats. *Brit. J. Pharmacol.*, Dec. 1957, **12**(4), 529-531.

DAS GUPTA, S.R. and WERNER, G. Inhibition of vasomotor reflexes by ajmaline. *Bull. Calcutta Sch. trop. Med.*, 1954, **1**(3), 16-17; *Indian J. med. Res.*, July 1954, **42**(3), 393-7.

DAS GUPTA, S.R. and WERNER, G. Pharmacological action of ajmaline. *Bull. Calcutta Sch. trop. Med.*, 1954, **1**(2), 16.

DAS GUPTA, S.R. and WERNER, G. Pharmacological investigation with serpine. *Bull. Calcutta Sch. trop. Med.*, 1954, **1**(4), 1-3.

DAS GUPTA, S.R. et al. Central actions of *R. serpentina*. *Indian J. med. Sci.*, 1953, **7**(11), 597-602.

DAS GUPTA, S.R. et al. (Pharmacological action of *R. serpentina* alkaloids). *Symposium on Indigenous Drugs & Insecticides* (Nat. Instt. Sci., India, Bull. No. 4). New Delhi, 1955, 35 pp.

DAS GUPTA, S.R. et al. The sympathiocolytic activity of *R. serpentina*, Benth. *Indian J. med. Sci.*, 1953, **7**(5), 229-35.

DASKALOV, D. et al. Experience with therapeutic effect of serpasil in psychiatric therapy (in Bulgarian). *Suvrem. med.* (Sofia), 1957, **8**(10), 32-39.

DASTUGUE, G. and HOSPITAL, P. Total extracts of *Rauwolfia serpentina* and reserpine; in vitro demonstration of anti-acetylcholine effects; proposal for biological determination (in French). *Therapie* (Paris), 1956, **11**(5), 884-887.

DAVIES, D.L. Clinical trials with special reference to reserpine (in French). *Encephale*, 1956, **45**(4), 1031-1034.

DAVIES, D.L. and SHEPHERD, M. Reserpine in the treatment of anxious and depressed patients. *Lancet*, 16 July, 1955, **269**, 117-20.

DAVIGNON, A. et al. Placebo and arterial hypertension (in French). *Un. med. Canad.*, 1956, **85**(1), 36-9. (Comparison with placebos and rescinnamine).

DAVIS, G.D. Effects of central excitant and depressant drugs on locomotor activity in monkey. *Amer. J. Physiol.*, 1957, **188**, 619-623 (includes reserpine).

DAVISON, A.N. et al. The antagonism of reserpine hypothermia by iproniazid. *Experientia*, Aug. 1957, **13**(8), 329-330.

DAWSON, D.J.C. et al. Reserpine in schizophrenia. (Lett.). *Lancet*, 13 Sept. 1958, No. 7046, 589.

DE ALVAREZ, R.R. Use of hypotensive agents in treatment of preeclamptic toxemia of pregnancy. *Obstet. Gynaec.*, July 1955, **6**(1), 55-62.

DEB, A.K. A few observations on *R. serpentina* in the treatment of mental diseases. *Calcutta med. J.*, 1954, **51**(6), 211-12.

DEB, A.K. *Rauwolfia serpentina*. *Indian med. Rec.*, Dec. 1947, **63**, 65; 359-360.

DEB, A.K. *Rauwolfia serpentina* in the service of mental disease. *Indian med. J.*, 1955, **49**, 195.

DEB, A.K. Response to *R. serpentina* in insulin and electro-convulsive therapy resistant patients, some untoward effects of electro-convulsive therapy followed by modified insulin. *Indian J. Neuerol. Psychiat.*, 1954, **5**, 49-54.

DE CARO, D. Extrapyramidal and convulsive manifestations observed during therapy with reserpine, clinical contribution and graphic E.E. *Acta neurol.* (Napoli), 1956, **11**(2), 426-453.

DE FELICE, E.A. Effect of reserpine (Serpasil), on increased oxygen consumption induced by triiodothyromine. *Experientia*, Aug. 1957, **13** (8), 323-324.

DE FELICE, E.A. Effect of reserpine (Serpasil) on renal hemodynamics and sodium and chloride excretion in the anesthetized dog. *Arch. int. Pharmacodyn.*, Feb. 1958, **114**, 1-13.

DE FELICE, E.A. Plasma disappearance and urinary excretion of reserpine (Serpasil) in the unanesthetized dog. *Experientia*, Sept. 1957, **13**(9), 373-374.

DE FELICE, E.A. et al. Effect of reserpine (Serpasil) on electrolyte excretion and water diuresis in normal subjects. *Arch. int. Pharmcodyn.*, 1 Feb. 1950, **114**(1), 14-22.

DE FELICE, E.A. et al. Effect of reserpine (Serpasil) on oxygen consumption of euthyroid, hypothyroid and hyperthyroid guinea pigs. *Proc. Soc. exp. Biol.* (N.Y.), Jan. 1957, **94**(1), 171-174.

DE FELICE, E.A. et al. Effect of reserpine (Serpasil) on urine flow and electrolyte excretion in "normal subjects". *Fed. Proc.*, Mar. 1957, **16**, 290 (abstract).

DE FEO, V.J. and REYNOLDS, R.M. Modification of the menstrual cycle in Rhesus monkeys by reserpine. *Science*, 1956, **124**, 726-727.

DE FEO, V.J. and REYNOLDS, S.R. Pharmacological suppression of ovulation and menstruation in monkeys. *Rev. gynec. Obst.* (Rio de J.), Jan. 1957, **51**(1), 53-61 (includes reserpine).

DEININGER, ROLF. Pharmacological investigation of an alkaloidal factor of *Rauwolfia serpentina*. *Pakist. J. sci. indust. Res.*, 1958, **1**(1), 6.

DEITZ, G.W. Treatment of angina pectoris; a double blind study. *Amer. Practit.*, 1955, **6**(12), 1872-5.

DE KRUIF, P. *Rauwolfia*. *Minn. Med.*, 1954, **37**(12), 867-72.

DEL EMPIRISMO. From the empirical medicine of ancient India to modern science (in Spanish) *Arch. urug. Med.* 1954, **44**(3-4), 231-2.

DELAY, J. et al. Additions to our experience with reserpine (in French). *Encephale*, 1956, **45**(4), 1042-1048.

DELAY, J. et al. Extrapyramidal movement disorders during chlorpromazine and reserpine therapy, clinical and electromyographic studies (in French). *Encephale*, 1956, **45**(4), 1093-1098.

DELAY, J. et al. Neuroplegic medications and cures in psychiatry: preliminary trials with reserpine; comparison with the effects of chlorpromazine (in French). *Pr. med.*, 4 May 1955, **63**(32), 663-5.

DELGADO ROIG, J. and FRANCO HERNANDEZ, M. Use of reserpine in psychiatric practice (in Spanish). *His. med.*, Oct. 1955, **12**(136), 507-12.

DELLA-PIETRA, V. and FINA, G. A case of acute cerebral edema during reserpine therapy (in Italian). *Osp. psichiat.* (Napoli), Jan.-Mar. 1956, **24**(1), 91-95.

DELLA PIETRA, V. and FINA, G. Pathogenesis of spontaneous convulsive seizures during reserpine therapy and the effect of reserpine in epilepsy (in Italian). *Osp. psihiat.* (Napoli), Jan.-Mar. 1957, **25**(1), 29-42.

DEMAAR, E.W.J. et al. Psychic effects of combined administration of *Rauwolfia* alkaloids and imporniazid. *Fed. Proc.*, Mar. 1957, **16**, 291 (abstract).

DEMEULENAERE, L. Experience with adelphan therapy in 25 cases of essential hypertension. *Belg. Tijdschr. Geneesk.*, 1 Oct. 1955, **11**(9), 955-959.

DEMING, Q. et al. Possible role of serotonin on the hypotensive and hypothermic actions of reserpine. *Fed. Proc.*, Mar. 1956, **15**, 416 (abstract).

DE, M.N. and CHATTERJEE, T. Combined digitalis and *Rauwolfia* poisoning in human subjects (attempting suicide). *Indian med. Gaz.*, Dec. 1941, **76**, 724-726.

DE, NAGENDRANATH. Clinical pharmacology of *Rauwolfia serpentina. Proc. 37th Ind. Sci. Congr.*, 1950, *Sec. Med. & Vet. Sci.*, Abst. pt. III, p. 194-5.

DE, NAGENDRANATH. Parkinsonism due to *R. serpentina. Proc. 41st Ind. Sci. Congr.*, 1954, *Abst. Sec. Med.*, pt. III, pp. 209-10.

DE, NAGENDRANATH. Toxic symptoms due to *R. serpentina. Proc. 35th Ind. Sci. Congr.*, 1948, pt. III, *Abst. Sec. Physiology*, p. 231.

DE NEGRI, M. Our experiences with the use of reserpine in child neuropsychiatry (in Italian). *Sist. nerv.* (Milano), Mar.-Apr. 1957, **9**(2), 57-68.

DENIKER, P. Hibernation and tranquilizing agents in psychiatric therapy (in French). *Encephale*, 1957, **46**(3), 281-398 (includes reserpine).

DENNIS, E. et al. Cardiovascular and renal hemodynamic response (acute and chronic) to reserpine. *Fed. Proc.*, 1954, **13**, 347.

DENNIS, E. et al. Pentolinum and hexamethonium combined with *Rauwolfia* in the treatment of hypertension. *New Engl. J. Med.*, 6 Oct. 1955, **253**, 597-600.

DENNIS, E. et al. Treatment of hypertension; longterm results with alseroxylon (Rauwiloid) alone and combined with hexamethonium administered orally. *Postgrad. Med.* (Minneapolis), Oct. 1954, **16**(4), 300-7.

DENNISON, A.D. *Jr.* The drug treatment of mild hypertension with particular reference to reserpine alkaloids and protoveratrine. *Trans. Amer. College of Cardiology*, Dec. 1955, **5**, 96-100.

DENNISON, A.D. et al. Effect of reserpine upon the human electroencephalogram. *Neurology*, 1955, **5**(1), 56-58.

DENNY, J.L. et al. Clinical evaluation of drug therapy in hypertension. *Amer. J. med. Sci.*, Aug. 1955, **230**(2), 169-77.

DESCLIN, L. Effect of reserpine on the mammary gland of normal rat, hyposectomized rat and hypophysectomized rat with a pituitary graft within the renal capsule (in French). *C.R. Soc. Biol.* (Paris), 1957, **151**(10), 1774-1776.

Deserpidine. *J. Amer. med. Ass.*, 1 Mar. 1958, **166** (Special No.), 1329-1230.

DESHAIES, G. et al. Chlorpromazine and reserpine psychiatry (in French). *Ann. med. Psychol.*, Mar. 1957, **115**, **1**(3), 417-476.

DESMOND, M.M. et al. Management of toxemia of pregnancy with reserpine. II. The new born infant. *Obst. Gynec.* (N.Y.), Aug. 1957, **10**(2), 140-145.

DE WITTE, P. Methonium compounds, hydrazinophthalazine and reserpine in therapy of hypertension (in French). *Acta clin. belg.* (Brussels), May-June 1954, **9**(3), 193-218.

DHAR, M.M. et al. Reserpine metabolism. *Indian J. Pharm.*, 1956, **18**(7), 293-96.

DHAR, M.M. et al. Studies on the metabolism of reserpine. Pt. I. Identification of metabolites. *J. sci. industr. Res.*, 1955, **14C**(10), 179-81.

DI GIOVAN-BATTISTA, N. Therapeutic effects of drug antagonists; combined reserpine-ritalin (Serpatonil) (in Spanish). *Prensa med. argent.*, 4 Oct. 1957, **44**(40), 3017-3019.

DILLON, D. and SWAIN, J.M. Gastro-intestinal hemorrhage as a complication of reserpine administration: Report of two cases. *Amer. J. Psychiat.*, Nov. 1956, **113**(5), 462-463.

DIMITRIU, C.C. et al. Reserpine (Serpasil), a *Rauwolfia serpentina* alkaloid in the therapy of hypertensive disease (in Italian). *Minerva med.* (Torino), 18 Apr. 1957, **48**(31), 1311-1313.

DIMITRIU, C.C. et al. Results of *Rauwolfia serpentina* alkaloid (Serpasil) in the therapy of hypertensive diseases (in Rumanian). *Med. int.* (Bucuresti), Oct.-Dec. 1955, **7**(4), 104-111.

DIMITRIU, V. et al. Serpasil therapy of mitral stenosis; effects of reserpine (Serpasil) on hemodynamics and clinical states of the patients of pure or combined mitral stenoses (in Rumanian). *Med. int.* (Bucuresti), Dec. 1956, **8**(8), 1189-1212.

DINKIN, L.G. Use of derivatives of *Rauwolfia serpentina* in the treatment of malnutrition. *New York J. med.*, 15 Feb. 1958, **58**(4), 505-510.

DIVRY, P. et al. Potentiated sleep therapy and neuroleptic therapy in psychiatry (in French). *Acta neurol. psychiat. belg.*, Mar. 1957, **57**(3), 185-201 (includes reserpine).

DOMINO, E. F. and RECK, R.H. Observation on the initial hypertensive response to reserpine. *J. Pharmacol.*, 1957, **121**, 171-182.

DONTAS, H.S. Effects of reserpine and hydralozine on carotid and splanchnic nerve activity and blood pressure. *J. Pharmacol.*, 1957, **121**, 1-7.

DOYLE, A.W. and SMIRK, F.H. Hypotensive action of reserpine. *Lancet*, 29 May 1954, **266**, 1096-7.

DOYLE, A.E. et al. Treatment of hypertension with reserpine, with reserpine in combination with pentapyrrolidinium and with reserpine in combination with veratrum alkaloids. *Circulation*, Feb. 1955, **11**, 170-181.

DOYLE, F.J. New drug in mental therapy and the implications of their use. *Hosp. Prog.* (St. Louis), 1955, **36**(3), 50-51.

DRAKE, F.R. and EBAUGH, F.G. The use of reserpine in office psychiatry; preliminary report. *Ann. N.Y. Acad. Sci.*, Apr. 1955, **61**(1), 198-205.

DRENICK, E.J. Reserpine in peptic ulcer. *Amer. J. dig. Dis.*, Dec. 1956, **1**(12), 521-525.

DRILL, V.A. (*ed.*) Pharmacology in medicine, New York, McGraw Hill, 1954 (*Rauwolfia serpentina:* pp. 34/6-34/7.)

DROVANTI, S. et al. Diuretic action of *R. serpentina* (in Italian). *Minerva Med.* (Torino), 28 Nov. 1954, **45**(95), 1403-7.

DUBANSKÝ, B. and BRABEC, J. The problem of reserpine effects on blood sugar (in German). *Psychiatria* (Basel), 1957, **134**(3-4), 284-288.

DUBE, A.H. et al. The effect of an analeptic (ritalin), an ataraxic (reserpine), and a placebo in senile states. *J. Chronic Dis.*, Feb. 1957, **5**(2), 220-234.

DUNSTAN, H.P. et al. Clinical experience with reserpine (Serpasil), a controlled study. *Ann. N.Y. Acad. Sci.*, Apr. 1954, **59**(1), 139-40.

DURLACH, J. The mammotropic action of reserpine. *Pr. med.*, 1957, **65**, 2060-2063.

DURLACH, J. Treatment of thinness by reserpine (in French). *Bull. Soc. med. Hop. Paris*, 10-17 Feb. 1956, 165-168; also in *Concours med.*, 18 Feb. 1956, **78**(7), 725-728.

DUTTA, R.K. *R. serpentina* alkaloids in the treatment of hypertension. *Patna J. Med*, 1944, **28** (8), 377-82.

DUTZ, H. and VOIGT, K. Effects of serpasil and salt on experimental hypertension in rats. *Z. ges. exp. Med.*, 1957, **129**(3), 305-313.

DUTZ, H. et al. Clinical course and histological changes of the kidneys in experimental nephritis in rats treated with reserpine (in German). *Z. ges. exp. Med.*, 1957, **129**(3), 298-304.

DZIOBA, H. et al. Treatment of hypertension with serpasil (in Polish). *Pol. Med. Wkly.*, 30 July 1956, **11**(31), 1375-1378.

EARL, A. E. A report on the tranquilizing effect of reserpine (Serpasil). *Internat. J. Anesthesia*, June 1954, **1**(4), 214-9.

EARL, A.E. Reserpine induced emesis in pigeons, a possible assay. *J. Pharmacol.*, Jan. 1955, **113** (1), 17.

EARL, A.E. Reserpine (Serpasil) in veterinary practice. *J. Amer. Vet. med. Ass.*, 1 Sept. 1956, **129**(5), 227-233.

EARL, A.E. et al. Assay of reserpine based on emesis in pigeons. *J. Pharmacol.*, Sept. 1955, **115**(1), 55-60.

EARL, A.E. et al. Effect of reserpine (Serpasil) on monkeys. A film narration. *Fed. Proc.*, 1954, **13**, 350; *Ann. N.Y. Acad. Sci.*, 1954, **59**, 8.

ECHT, M. Experience with raupina in therapy of hypertension (in German). *Dtsch. med. J.*, 15 Aug. 1954, **5**(15-16), 477-9.

EDERLE, W. Effects of Serpasil on the central nervous system (in German). *Nervenarzt*, 20 Jan. 1956, **27**(1), 33.

EDISEN, C.B. Chlorpromazine, methamphetamine serotonin, reserpine and effects on cat spinal cord. *Arch. Neurol. Psychiat.* (Chicago), Mar. 1958, **79**(3), 323-327.

EGDAHL, R.H. et at. Effect of reserpine on adrenocortical function in unanesthetized dogs. *Science*, 1956, **123**, 418.

EIBER, H.B. Chlorpromazine (thorazine) *Rauwolfia* combination in neuropsychiatry; preliminary report. *Arch. Neurol Psychiat.* (Chicago), July 1955, **74**(1), 36-9.

EIBER, H.B. Combined chlorpromazine *Rauwolfia serpentina* therapy in essential hypertension; preliminary report. *J. Amer. med. Ass.*, 2 July 1955, **158**(9), 730-1.

EIBER, H.B. Thorazine-*Rauwolfia serpentina* combination in the treatment of hypertension; preliminary report. *Bull. N.Y. Acad. Med.*, 1955, **31**(5), 407-8.

EICKE, W.J. Experience with megaphen, reserpine - serpasil and phasein in chronic psychosis (in German). *Nervenarzt*, 20 June 1958, **29** (6), 261-266.

ELAM, C.B. et al. Activity levels as a consequence of reserpine administration. *Air Force School of Aviation Medicine Report*, No. 56-132, Jan. 1957, 6 pp.

ELKES, C. *Rauwolfia* alkaloids and reserpine in the treatment of the chronic psychotic patient. *J. ment. Sci.* (Lond.), July 1957, **103** (432), 464-474.

ERANKO, O. and HOPSU, V. Effect of reserpine on the histochemistry and content of adrenaline and noradrenaline in the adrenal medulla of the rat and the mouse. *Endocrinology*, Jan. 1958, **62**(1), 15-23.

ERANKO, O. et al. Effect of prolonged administration of reserpine on the endocrine glands of the rat. *Nature*, 23 Nov. 1957, **180**(4595), 1130.

ERSHOFF, B.H. Potentiating effects of reserpine in thyrotoxicity in the rat. *Proc. Soc. exp. Biol.* (N.Y.), 1958, **99**, 189.

ERSPAMER, V. Effect of reserpine on the 5-hydroxytroptamine (enteramine) content of the serum, spleen, intestines and brain of the hen. *Naturwissenschaften*, 1956, **43**, 61-62.

ERSPAMER, V. Observations on the 5-hydroxytryptamine (enteramine) release caused by reserpine in the rat. *Experientia*, Feb. 1956, **12** (2), 63-64.

ERSPAMER, V. and CICERI, C. Action of reserpine on the 5-hydroxytryptamine (Enteramine) biosynthesis and metabolism in dogs and rats. *Experientia*, Feb. 1957, **13**(2), 87-89.

ESPLIN, D.W. and HEATON, D.G. Effects of reserpine on spinal cord synaptic transmission. *J. Pharmacol.*, 1957, **121**, 267-271.

ESSELLIER, A.F. et al. Chemotherapy in hypertension; clinical experience with serpasil, serpasil-retalin and serpasil-reprosil (in German). *Schweiz. med. Wschr.*, 20 Aug. 1955, **85**(34), 808-811.

Essential hypertension (editorial). *Med. Times* (Great Neck), 1953, **81**, 226 (incl. ref. to *R. serp.*).

ESTOFAN, M.E. Reserpine and body weight, preliminary note (in Spanish). *Sem. med.* (B. Aires), 16 Jan. 1958, **112**(3), 92-94.

ETTELDORF, J.N. et al. Effect of reserpine and its combination on blood pressure and renal acute nephritis in children. *J. Pediat.*, 1956, **48** (3), 129-39.

EVELBAUER, K. and BUNKA, H. The role of autonom c pelvipathy (Gauss's concept in gynaecological outpatient service) (in German). *Munch. med. Wschr.*, 20 Jan. 1956, **98**(3), 77-9.

EVERETT, G.M. et al. Central and peripheral effects of reserpine and 11-desmethoxyreserpine (Harmonyl) on the nervous system. *Fed . Proc.*, Mar. 1957, **16**, 295 (abstract).

Experience with reserpine in therapy of mental disease patients (in French). *Sem. med. Prof.* (Paris), 14 Feb. 1957, **33**(6), 255.

FAERCHTEIN, I. Combined hexamethonium, 1-hydrazinopthalazine and *Rauwolfia serpentina* therapy of arterial hypertension (in Portuguese). *Med. cirurg. Pharm.*, Feb.-Mar. 1957, No. 250-251, 72-86.

FAERCHTEIN, I. and GINEFRA, P. Combined 1-hydrazinophthalazine and *R. serpentina* in therapy of arterial hypertension (in Portuguese). *Med. cirurg. Pharm.*, May 1955, No. 229. 163-72.

FARBROT, O. Reserpine with Huntington's chorea; report of two cases (in Norwegian). *Tidsskr. norske. Laegforen*, 15 Sept. 1956, **76**(18), 656-658.

FAUCETT, R.L. et al. Neuropharmacologic action of *Rauwolfia* compounds and its psychodynamic implications. *Arch. Neurol. Psychiat.* (Chicago), May 1957, **77**(5), 513-518.

FAURE, J.L. and ABRIC, J. Clinical notes on useful indications of chlorpromazine and reserpine in infantile psychiatry (in French). *Pediatrie*, 1956, **11**(7), 773-776.

FERGUSON, J.T. Comparison of reserpine and harmonyl in psychiatric pateints. A preliminary report. *J. Lancet*, 1956, **76**, 389-390.

FERGUSON, J.T. Treatment of reserpine-induced depression with a new analeptic: phenidylate. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 101-7.

FERGUSON, J.T. and FUNDERBURK, W.H. Improving senile behaviour with reserpine and ritalin; new approach with use of methyl phenylpiperidyl acetate. *J. Amer. med. Ass.*, 28 Jan. 1956, **160**(4), 259-63.

FERGUSON, R.S. Influences of reserpine on E.C.T. Preliminary observations. *J. ment. Sci.* (Lond.), Oct. 1956, **102**, 826-829.

FERNANDES, B. Chlorpromazine, reserpine and the pharmaco-psychiatric convocation (in Portuguese). *J. Med.* (Porto), 4 Feb. 1956, **29**(680), 237-43.

FERRARA, F.A. and CORTE, A. *R. serpentina* and reserpine in arterial hypertension (in Spanish). *Prensa med. argent.* (B. Aires), 3 June 1955, **42** (22), 161-29.

FERRARA, R.J. and PINKUS, H. Alseroxylon in the treatment of pruritic and psychogenic dermatoses. *Arch. Dermat.* (Chicago), July 1955, **72** (1), 23-29.

FERRARIS, F. and QUINZANI, F. Further research on the treatment of hypertensive kidney disease in pregnancy; combined phthalazine-reserpine therapy (in Italian). *Minerva gin.* (Torino), 15 July 1956, **8**(13), 556-559.

FIFE, R. et al. Treatment of hypertension in outpatients. The initial assessment and the effect of reserpine. *Scott. med. J.*, Apr. 1955, **3**, 165-172.

FINNERTY, F. A. Value of *R. serpentina* in the hypertensive patient. *Amer. J. Med.*, Nov. 1954, **17**(5), 629-40.

FINNERTY, F.A. and SITES, J.G. The value of parenteral reserpine in acute hypertension. *Amer. J. med. Sci.*, Apr. 1955, **229**(4), 379-85.

FISCHER, E. Reserpine (Serpasil) in mental deficiency practice. *J. ment. Sci.* (Lond.), July 1956, **102**(428), 542-545.

FISCHER, P and LECOMTE, J. Anaphylactic shock in rabbit treated with reserpine (in French). *C.R. Soc. Biol.* (Paris), 26 Sept. 1956, 1026-1028.

FLACH, F.F. Clinical effectiveness of reserpine. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, 161-6.

FLACHS, A. et al. Ambulant long-term treatment of arterial hypertension with reserpine (Serpasil) alone, or combined with Ansolysen (in Danish). *Ugeskr. Laeg.*, 3 Oct. 1957, **119**, 1306-1310.

FLEMING, T.S. *Rauwolfia serpentina* and its alkaloids. *Missouri Med.*, 1954, **51**(9), 754-5.

FLUGEL, F. Neuro-psychiatric experience with the effects of *Rauwolfia* alkaloids, reserpine (Serpasil) (in German). *Med. Klin.*, 31 Mar. 1955, **50**(13), 509-10.

FLUGEL, F. Parkinson—like manifestations produced by medicamentation (in German). *Med. Klin.*, 15 Apr. 1955, **50**(15), 634-5.

FLUGEL, F. et al. Experience with a modified chlorpromazine-reserpine combination in endogenous psychoses (in German). *Dtsch. med. Wschr.*, 21 Mar. 1958, **83**(12), 445-448.

FLUHMANN, C.F. Effect of *R. serpentina* on thyroid and pituitary glands of young rats. *Proc. Soc. exp. Biol.* (N.Y.), 1956, **93**, 615.

FOGEL, E.J. Physiological studies after continuous serpasil therapy over 18 months. *Dis. nerv. Syst.*, Oct. 1956, **17**(10), 322-323.

FOOTE, E.S. Combined chlorpromazine and reserpine in the treatment of chronic psychotics. *J. ment. Sci.* (Lond.), Jan. 1958, **104**(434), 201-205.

FOOTE, E.S. Reserpine in treatment of chronic psychotics; preliminary observations. *Brit. med. J.*, 14 May 1955, 1192-3.

FORD, R.V. Treatment of hypertensive emergencies, a study of the comparative effects of parenteral *Rauwolfia* preparations. *J. Lab. clin. Med.*, Nov. 1956, **48**(5), 807.

FORD, R.V. and MOYER, J.H. Extract of *R. serpentina* in hypertension. *G.P.* (Kansas City), Nov. 1953, **8**(5), 51-6.

FORD, R.V. and MOYER, J.H. Preliminary observations of Rauwiloid-hexamethonium combined therapy of hypertension. *Amer. Heart J.*, Nov. 1953, **46**(5), 754-63.

FORD, R.V. and MOYER, J.H. *Rauwolfia* toxicity in the treatment of hypertension; comparative toxicity of reserpine and alseroxylon. *Postgrad. Med.*, Jan. 1958, **23**, 41-48.

FORD, R.V. and ROCHELLE, J.B. Modification of cardiovascular abnormalities by whole root of *Rauwolfia;* especially hypertensive angina. *Texas J. med.*, Dec. 1957, **53**,(12), 127-29.

FORD, R.V. et al. A comparative study of the effects of four different *Rauwolfia* preparations administered parenterally. *J. Pharmacol.*, June 1957, **120**(2), 247-254.

FORD, R.V. et al. Preliminary observations on *R. serpentina* therapy of hypertension. *Med. Res. & Ann.*, 1953, **47**, 608.

FORREST, A.D. Indole excretion patterns during treatment with reserpine. *J. ment. Sci.* (Lond.), July 1957, **103**(432), 614-620.

FORREST, A.D. Some observations on Huntington's chorea. *J. ment. Sci.* (Lond.), July 1957, **103**(432), 507-513 (includes treatment with reserpine).

FORESTER, W. et al. Reserpine in chronic psychoses. *J. Canad. med. Ass.*, 15 Dec. 1955, **73**(12), 951-6.

FOSTER, M.W. and GAYLE, R.F. *Jr.* Dangers in combining reserpine (Serpasil) with electroconvulsive therapy. *J. Amer. med. Ass.*, 17 Dec. 1955, **159**(16), 1520-2.

FOUKS, L. et al. The end of shock therapy and the advent of new psychiatric therapeutics; reserpine (Serpasil) (in French). *Ann. med. psychol.*, Dec. 1954, 112, **2**(5), 764-8.

FOX, C.L. et al. Comparative inhibition of anaphylaxis in mice by tranquillizers and other drugs. *Fed. Proc.*, Mar. 1957, **16**, 413 (abstract: includes reserpine).

FOX, S.D. Vasomotor rhinitis in hypertension. *Maryland med. J.*, 1956, **5**(3), 144-6.

FRANCO-BOROWDER, S. Pharmacologic characterisation of reserpine responses in rats pretreated with iproniazid. *Proc. Soc. exp. Biol.*, (N.Y.), 1958, **97**(4), 778-779.

FRANK, D.E. Practical significance and treatment anxiety. *Med. Times* (Great Neck), Sept. 1956, **84**(9), 924-928 (includes reserpine).

FRANKE, R. and THIELE, F. The permanent medicamentous oral treatment of chronic hypertension (in German). *Mediznische*, 1953, **50**, 1626.

FRASER, H.F. and ISBELL, H. Chlorpromazine and reserpine. A:Effects of each and of combinations of each with morphine. B:Failure of each in treatment of abstinence from morphine. *Arch. Neurol. Psychiat.* (Chicago), Sept. 1956, **76**(3), 357-362.

FRASER, H.F. et al. Urinary excretion of SHIAA corticoids after morphine, meperidine, nalosphine, reserpine and chlorpromazine. *Fed. Proc.*, Mar. 1957, **16**, 298 (abstract).

FREED, H. Chlorpromazine and reserpine, new era in psychiatry. *Amer. Practit. Dig. Treatment*, 1955, **6**(5), 706-8.

FREIS, E.D. Mental depression in hypertensive patients treated for long periods with large doses of reserpine. *New Engl. J. Med.*, 16 Dec. 1954, **251**(25), 1006-8.

FREIS, E.D. Recent developments in the treatment of hypertension. *Med. Clin. North Amer.*, 1954, **38**, 363 (includes reserpine).

FREIS, E.D. Treatment of the elderly hypertensive patient. *J. Amer. Geriat. Soc.*, **3**(9), 1955, 710-3.

FREIS, E.D. and ARI, R. Clinical and experimental effects of reserpine in patients with essential hypertension. *Ann. N.Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 45-53.

FREIS, E.D. and WILSON, I.M. Results of prolonged treatment with pentolinium tartrate with special reference to the addition of *Rauwolfia*, hydralazine or both. *Circulation*, June 1956, **13**, 856-865.

FREEMAN, H. A critique of the tranquilizing drugs, chlorpromazine and reserpine, in neuropsychiatry. *New Engl. J. Med.*, 8 Nov. 1956, **255** (19), 877-883.

FREEMAN, H. et al. Effects of chlorpromazine and reserpine in chronic schizophrenic patients. *Dis. nerv. Sys.*, 1956, **17**(7), 213-9.

FREMMING, K.H. and PERREGARRD, I. Serpasil as a sedative in psychiatric practice (in Danish). *Ugeskr. Læg.*, 12 May 1955, **117**(19), 599-603.

FRESIA, P. A new association of hypotensive drugs (in Italian). *Minerva Cardioangiol.* (Torino), Apr. 1957, **5**(4), 144-150 (includes reserpine).

FREY B. et al. Oculogyric crises during successive treatment with reserpine and chlorpromazine (in French). *Ann. med. Psychol.*, **115**, Mar. 1957, **1**(3), 545-519.

FREYDBERGLUCAS, V. Action of reserpine (Serpasil) on thyroid (in German). *Acta Endocr.* (Kbh.), 1956, **23**, 419-425.

FREYHAN, F.A. Psychomotility; extrapyramidal syndrome and mode of action of neuroleptic therapies, chlorpromazine, reserpine and prochlorperazine (in German). *Nervenarzt*, 20 Nov. 1957, **28**(11), 504-509.

FROMMEL, E. Sensitivity to ACH during stress. The effect of morphine, chlorpromazine, reserpine and ACTH on this sensitivity. *Schweiz. med. Wschr.*, 1957, **87**, 262-268.

FROMMEL, E. and GOLD, P. Sites of action of the total alkaloids of *Rauwolfia* and reserpine on the sleep centre. *Acta pharmacol.* (Kbh.), 1957, **13**, 345-346.

FROMMEL, E. et al. Does the pharmacological effect of total *Rauwolfia* alkaloids differ from that of reserpine? An experimental note (in French). *Praxis*, 1957, **46**(18), 402-404.

FROMMEL, E. et al. Experimental study of the peripheral and central sites of action of a triple hypotensive mixture, total *Rauwolfia* alkaloids, nitrocholine, and the manganese chloride of acetylcholine (manganocholine forte). *Schweiz. med. Wschr.*, 1957, **87**, 192-195.

GADDUM, J. H. et al. Action of reserpine on excretion of adrenaline and noradrenaline. *J. Neurochem.*, 1958, **2**, 249-253.

GAHAGAN, L.H. Ineffectiveness of chlorpormazine and *Rauwolfia serpentina* preparations in the treatment of depression. *Dis. nerv. Syst.*, Oct. 1957, **18**(10), 390-393.

GAITONDE, B. B. and LEWIS, R. A. Activity and toxicity of *R. serpentina*. *Indian J. Pharm.*, 1955, **17**(6), 110-14.

GALAMBOS, A. Essential hypertension, its treatment with *R. serpentina*. *Angiology*, Oct. 1954, **5**(5), 4499-4500.

GALANTE, G. Clinical trials with intramuscular selected useful *Rauwolfia* alkaloids (in Spanish). *Sem. med.* (B. Aires), 3 Oct. 1957, **111**(14), 696-703.

GALLI, G. Combined reserpine - hydrazinophthalazine in therapy of hypertension in private practice (in Italian). *Gazz. med. ital.*, June 1958, **117**(6), 254-257.

GALLI, G. Reserpine in the treatment of hypertension in private practice (in Italian). *Gazz. med. ital.* 1955, **114**(9), 200-4.

GALLOIS, J. et al. Reserpine and chronic glaucoma (in French). *Boll. Soc. ophthal. France*, June 1956, No. 6, 579-582.

GALUPPI, G.M. Clinical trials in hypertension with *Rauwolfia* alkaloids (in Italian). *Gazz. med. ital.* (Torino), 1955, **114**(3), 61-3.

GAMET, et al. Endocrine aspects of the pharmacology of reserpine. *Ann. N. Y. Acad. Sci.*, 1954, **59**, 22-35.

GANGLOFF, H. and MONNIER, M. Topic action of reserpine, serotonin, and chlorpromazine on the unanaesthetised rabbits' brain. *Helv. Physiol. Acta*, 1957, **15**, 83-104.

GANGLOFF, H. and MONNIER, M. Topical determination of cerebral impact of reserpine (Serpasil) (in German). *Experientia*, Oct. 1955, **11**(10), 404-7.

GANGULY, S. K. and BOSE, A. N. Uniform hypotensive extract from *R. serpentina*, Benth., collected from different sources. *Indian J. Pharm.*, 1956, **18**, 193-95.

GARAVAGLIA, G. Clinical results of total *R. serpentina* alkaloids (injectable or oral) in neuropsychiatry (in Italian). *Minerva med.* (Torino), 7 Nov. 1955, **46**(89), 1259-63.

GARCIA, J. A. and FERREIRA, L. R. Therapeutic tests on one of the *Rauwlofia serpentina* alkaloids (in Spanish). *Rev. bras. Med. Farm.*, May 1955, **12**(5), 291-294.

GARCIA TURIELLA, R.A. *Rauwolfia* in the treatment of arterial hypertension; preliminary communication on 16 treated cases (in Spanish), *Prensa med. argent.* (B. Aires), 26 Mar. 1954, **41**(13), 856-61.

GARIN, L. Preliminary effect of reserpine on modifications of lesser circulation (in Italian). *Riv. crit. Clin. med.* 31 Oct. 1954, **54**(5), 508-23.

GARIN, L. et al. Further experimental studies to determine the mechanism of action of reserpine on pulmonary circulation in pathological conditions (in Italian). *Riv. crit. Clin. med.*, 31 Oct. 1957, **57**(3-4), 199-210.

GARRIDO-GARRIDO, M. *Rauwolfia serpentina* alkaloid in hypertension (in Spanish). *Sem. med.* (B. Aires), 31 Mar. 1958, **112** (Suppl.1), 21-23.

GASSNER, A. First clinical experiences with a purified *Rauwlofia* alkaloid combination preparation (in German). *Munch. med. Wschr.*, 26 July 1957, **99**(30), 1075-1078.

GAUCHAT, R.D. and FEATHERSTONE, R.M. Prolongation and enhancement of the tranquillizing action of reserpine by glucose in the monkey. *Fed. Proc.*, Mar. 1956, **15**, 426 (abstracts).

GAUNT, R. et al. Effect of reserpine (Serpasil) and hydralazine (Apresoline) on experimental steroid hypertension. *Amer. J. Physiol.*, July 1955, **182**(1), 63-8.

GAUNT, R. et al. Endocrine aspects of the pharmacology of reserpine. *Ann. N. Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 22-35.

GAYER, J. and HONHEISER, G. Effect of *Rauwolfia serpentina*, Benth. alkaloids on blood sugar. (in German). *Arzneimittel Forschung* (Munich), 10 Feb. 1956, **10**(2), 1/98-100.

GAYRAL, L. et al. Chlorpromazine and reserpine after insulin shock therapy in schizophrenia (in French). *Encephale*, 1956, **45**(4), 663-667.

GELLER, W. and MAPPES, C. Tolerance of high doses of serpasil (in German). *Arztl. Wschr.*, 11 May 1956, **11**(19), 413-417.

GENEST, J. et al. Clinical uses of *Rauwolfia*. I. In arterial hypertension. *J. Canad. med. Ass.*, 1 Apr. 1955, **72** (7), 483-9.

GENEST, J. et al. Clinical uses of *Rauwolfia*. II. In psoriasis and in constitutional leanness. *J. Canad. med. Ass.*, 1 Apr. 1955, 490-491.

GENEST, J. et al. New therapeutic use of reserpine and *Rauwolfia* extracts (in French). *Un. med. Can.*, 1954, **83**(8), 915-6.

GERARD, D. L. et al. Reserpine in the postwithdrawal rehabilitation of adolescent opiate addicts. *Arch. Neurol. Psychiat.* (Chicago), July 1956, **76**(1), 106-8.

GERMANO, V. and BELLAVITIS, U. First clinical observations on the parenteral use of *Rauwolfia*

alkaloids in psychiatry (in Italian). *Riv. sper. Freniet.*, 30 Sept. 1955, **79**(3), 713-22.

GERSTENBRAND, F. and WEINGARTEN, K. Serpasil treatment of extrapyramidal hyperkinesia (in German). *Wien. klin. Wschr.*, 17 Aug. 1956, **68**(33), 656-659.

GETTELFINGER, W.C. Management of essential hypertension. *J. Kentucky St. med. Ass.*, 1953, **51**, 434.

GEYER, E. Injurious effects of *Rauwolfia* (in German). *Z. ges. inn. Med.*, 1 Oct. 1956, **11**(19), 902-905.

GHAFFAR, Y.A. and ATTIAH, M. *Rauwolfia serpentina* Benth. in hypertension. *J. Egypt. med. Ass.*, 1955, **38**(7), 447-50.

GHANEM, M.H. Blood coagulation and reserpine. *Alexandria med. J.*, 1956, **2**(2-3), 146-163.

GHANEM, M. H. Rectal reserpine. *Lancet*, 15 Feb. 1958, **1**(7016), 378-379.

GHANEM, M.H. The response to reserpine suppositories. *Alexandria med. J.*, 1958, **4**(1), 22-34.

GHANEM, M.H. and NAIM, M. The immediate cardiac effect of intravenous reserpine. *Alexandria med. J.*, 1956, **2**(2-3) 164-166.

GHOSH, B.P. and GUPTA, J.C. Studies on cardiovascular renal function in hypertension treated with *R. serpentina* Forte. A preliminary report. *Indian J. Pharm.*, 1956, **18**(7), 311-15.

GIBBONS, J.E. et al. Newer drugs in treatment of hypertension. III. Experience with *Rauwolfia* drugs and protoveratrine. *J. Amer. med. Ass.*, 8 Sept. 1956, **162**, 92-94.

GIBERTI, F. and BONAMINI, F. Changes in music tone and carriage induced in dogs by intracisternal administration of reserpine (in Italian). *Boll. Soc. ital. Biol. sper.*, July-Aug. 1956, **32**(7-8), 698-699.

GIBERTI, F. and GARELLO, L. Results of reserpine therapy in psychiatry (in Italian). *Sist. nerv.*, Jan.-Feb. 1955, **7**(1), 29-42.

GIBERTI, F. and GREGORETTI, L. First trials of psychopharmacological antagonism; experimental psychoses induced with *d*-lysergic acid diethylamine and treated with cholrpromazine and reserpine (in Italian). *Sist. nerv.*, July-Aug. 1955, **7**(4), 301-10.

GIBERTI, F. and SORIANI, S. Lesions of the central nervous system induced in the rat by reserpine (in Italian). *Boll. Soc. ital. Biol. sper.*, July-Aug. 1956, **32**(7-8), 699-702.

GIBERTI, F. and SORIANI, S. Modification of behaviour and histological changes of the central nervous system induced in the rat by reserpine administration (in Italian). *Sist. nerv.*, May-June 1957, **9**(3), 127-136.

GIBERTI, F. et al. Further results of new therapy of Parkinsonian syndromes; therapeutic action 3-phenyl-3-β-diethylaminoethyl-2-6-dioxy - piperidine hydrochloride administered alone with reserpine and ritalin (in Italian). *Gazz. med. ital.* (Milano), Sept. 1957, **116**(9), 404-407.

GIFFORD, R.W. New medicines for the treatment of hypertension. *Klin. Wschr.*, 1956, **34**(3-4), 57-61 (includes *R. serpentina*).

GILLIS, C.N. and LEWIS, J.J. Action of reserpine on isolated intestinal muscle. *Nature*, 20 Apr 1957, **179**, 820.

GILLIS, C.N. and LEWIS, J.J. Antagonists of the action of reserpine on smooth muscle. *Nature*, 20 Oct. 1956, **178**, 859.

GILLIS, C. N. and LEWIS, J.J. Metabolic and other effects of reserpine upon smooth and skeltal muscle. *Brit. J. Pharmacol.*, 1957, **12**, 517-520.

GILLIS, C.N. and LEWIS, J.J. Note on the pharmacology of reserpine. *J. Pharm.* (Lond.), 1956, **8**(8), 606-14.

GIOVANNELLI, G. Serpasil in states of excitement (in Italian). *Rass. Studi. Psichiat.*, 1956, **45**(5), 1179-1181.

GLOVE, C. Results obtained with reserpine therapy at the psychiatric hospital of Reggio Calabria (in Italian). *Rass. Studi. Psichiat.*, Mar.-Apr. 1957, **46**(2), 277-88.

GIRARD, R. and CORTESI, R. *Rauwolfia serpentina*, Benth. *Acta Phytother.*, 1956, **3**(5), 1-5.

GIROD, C. and SLIMANE-TALEB, S. Action of reserpine cortico-suprarenal activity in the monkey. *C. R. Soc. Biol.* (Paris), 1957, **151**, 1158-1161.

GLAZKO, A.J. et al. Metabolic studies with reserpine. *Fed. Proc.*, 1955, **14**, 58; also *J. Pharmacol.*, 1956, **118**, 377.

GLEZER, G. A. The use of reserpine in hypertension in disease in ambulatory treatment (in German). *Klin. Med.*, 1958, No.3, 65-57.

GLYNN, J.D. *Rauwolfia serpentina* in psychiatry. *J. Neurol. Psychiat.*, Aug. 1955, **18**(3), 225-7.

GOGERTY, J.H. et al. Modifications of actions of LSD-25 by reserpine. *Fed. Proc.*, Mar. 1957, **16**, 300 (abstract).

GOING, H. and KEMPE, H.D. Control of experimentally produced arrhythmias by vegetable materials having cardiac action. *R. serpentina*, khelline camphor, *R. valerianae* (in German). *Arch. int. Pharmacodyn.*, 1956, **107**, 255.

GOLD, M. I. and STONE, H. H. Tranquilizing drugs: classification and pharmaclogical survey. *Anesthesiology*, 1957, **18**, 357-371 (includes reserpine).

GOLDBERG, B. Renal haemodynamic effects of hypotensive drugs. I. Acute effects of hexamethonium bromide before and after treatment with reserpine. *Lancet*, 12 Jan. 1957, **272**(6959), 74-77.

GOLDIN, A. et al. Antileukemic action of reserpine. *Science*, 1957, **125**, 156-157.

GOLDMAN, D. Comparison of clinical effects of chlorpromazine and reserpine in psychotic patients. *Amer. J. med. Sci.*, Feb. 1957, **233**(2), 137-144.

GOLDSTEIN, M. S. and RAMEY, E. R. Effect of reserpine on stress response of adrenalectommized animals. *Fed. Proc.*, Mar. 1957, **16**, 48 (abstract).

GOLDSTEIN, SAMUEL, W. New drugs—old drugs. *Amer. J. Pharm.*, 1954, **126**(12), 404-8 (ref. to *R. serp.*)

GOLWALA, A.F. et al. Treatment of hypertension emergencies with combination of veratrum and *Rauwolfia*. *Curr. med. Practit.*, 1957, **1**, 161-64.

GOMIRATO, G. Uses of chlorpromazine and reserpine as evaluated by two assemblies (in Italian). *Minerva med.* (Torino), 21 Nov. 1955, **46**(93), 1449-52.

GOMIRATO, G. et al. Comparing action of chlorpromazine and reserpine on the neuro-vegetative system; effect on nervous regulations of the circulation. *Acta neurol.* (Napoli), 1957, **62**(2), 116-132.

GONNARD, P. and SCHMITT, HENRI. Comparative study of the sedative action of two *Rauwolfia* alkaloids: reserpine and reserpinine. *Lebanese Pharm. J.*, 1957, **5**, 24-27.

GONNARD, P. et al. Action of reserpine on the electroencephalogram of the rabbit. *Arch. int. Pharmacodyn.*, 1957, **110**, 265-274.

GOODMAN, J.R. et al. Reserpine and thyroid function. *Proc. Soc. exp. Biol.* (N. Y.), Oct. 1955, **90**(1), 196-8.

GOODMAN, L. S. and GILMAN, A. Pharmacological basis of therapeutics. 2nd ed. New York, Macmillan, 1956. (*Rauwolfia*, pp. 754-56).

GORDON, HIRSCH L. (*ed*). The new chemotherapy in mental illness; the history, pharmacology and clinical experiences with *Rauwolfia*, hydroxyzine and benactyzine preparations. New York, Philosophical Library. 1958. xvii, 762 pp.

GORE, C.P. et al. The place of reserpine in the treatment of the chronic psychotic patient. *Amer. J. Psychiat.*, Oct. 1957, 11 **114**(4), 333-337.

GOULD, H. A. and SHERROD, T. R. Reserpine on renal hemodynamics in the trained unanesthetized dog. *Fed. Proc.*, Mar. 1957, **16**, 301 (abstract).

GOURZIS, J. R. Influence of rauwiloid, alkaloidal extract of *R. serpentina* on veratrum-induced emasis in dogs. *Proc. Soc. exp. Biol.* (N. Y.), May 1955, **89**(1), 57-9.

GOURZIS, J.R. et al. Alterations in cardiovascular response of dog following rauwiloid, an alkaloidal extract of *R. serpentina*. *Proc. Soc. exp. Biol.* (N. Y.), 1954, **85**(3), 463-6.

GOVEA PENA, J. and AMADO LEDO, E. Chlorpromazine in potentiation of various hypotensive drugs in therapy of chronic arterial hypertension (in Spanish). *Arch. Hosp. Univ.* (Havana), July-Aug., 1955, **7**(4), 269-74.

GRAMSCH, H. A combination treatment of arterial hypertension (in German). *Arztl. Wschr.*, 29 Apr. 1955, **10**(17), 394-7.

GRANDON, R.C. et al. A new medical adjunct to the treatment of alcoholism; the use of reserpine. *Amer. Practit. Dig. Treatment*, 1956, **7**(2), 231-4.

GRANIER, M. and HORANDE, M. Association of *Rauwolfia serpentina* and papaverine, experimental trial of its hypotensive effect on the dog (in Spanish). *Gac. med. Caracas*, Jan.-Feb. 1956, **64**(1-2), 75-80.

GREEN, H.D. Pharmacology of antihypertensive drugs. *Clin. Sympos.*, Sept.-Oct. 1957, **9**(4), 139-147 (includes *Rauwolfia* preparations).

GREEN, J.P. et al. Blood 5-hydroxytryptamine (Serotonin) levels after reserpine and electroshock therapy. *Proc. Soc. exp. Biol.* (N.Y.), 1957, **94**, 428-430.

GREEN, R. S. and DAVOLOS, D. A long-term study of the effects of crude *Rauwolfia serpentina* and of its alseroxylon fraction in patients with hypertension. *Amer. J. Med.*, May 1956, **20**, 760-773.

GREENBLATT, R.B. Use of reserpine (Serpasil) in certain gynaecologic disorders. *Ann. N.Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 133-5.

GREENFIELD, A.R. A new type of sedation for the acute alcoholic. *Amer. Practit. Dig. Treatment*, 1956, **7**(2), 241-4.

GREENHOUSE, H. R. and PILOT, M. L. Reserpine as an adjunct in the treatment of alcoholism. *Q. J. Alcohol*, Sept. 1957, **18**(3), 468-474.

GREGORY, DAVID. Gynecomastia and reserpine. (Lett.). *J. Amer. med. Ass.*, 6 Sept. 1958, **168** (1), 136.

GRIFFIN, R.W. et al. Treatment of hypertensive emergencies: parenteral use of reserpine. *New Engl. J. Med.*, 29 Mar. 1956, **255**, 593-598.

GRILLI, H. Clinical trials with a derivative of *Rauwolfia serpentina* administered intramuscularly (in Spanish). *Prensa med. argent.*, 2 Nov. 1956, **43**(44), 3277-3281.

GRIMM, M. R. Effect of reserpine phosphate on dividing onion root tip cells. *Proc. Soc. exp. Biol.* (N.Y.), 1958, **98**(2), 252-253.

GRIMSHAW, J.A. Chlorpromazine and reserpine, limitations of their use in office practice. *J. Kans. med. Soc.*, Nov. 1956, **57**(11), 687-689.

GRIMSON, K,S.. Drugs recently introduced for hypertension. *J. Amer. med. Ass.*, 4 June 1956, **158**(5), 359-367 (including *R. serpentina* and reserpine).

GRONBAEK, P. and Thomsen, A. C. Reserpine therapy of essential hypertension (in Danish). *Ugeskr. Laeg.*, 5 May 1955, **117**(18), 575-9.

GROSS, F. et al. Comparative studies of medicamentous hypertension (in German). *Klin. Wschr.*, 1 Apr. 1955, **33**(13-14), 372-8.

GRUNER, A. and STURUP, H. Ambulant reserpine and hydralazine therapy of mild hypertension over a long period (in Danish). *Ugeskr. Laeg.*, 3 Oct. 1957, **119**(40), 1303-1305.

GRUNG, P. and SUNDBY, P. Treatment of Huntington's chorea (in Norwegian). *Tidsskr. norske. Laegeforen*, 15 Feb. 1957, **77**, 158-160, (with reserpine).

GRUPPER, C. *R. serpentina* therapy of pruritis in dermatology; preliminary report (in French). *Bull. Soc. Franc. Derm. Syph.* (Paris), Mar.-Apr. 1955, No. 2 159-62.

GUKASIAN, A.G. and DIATLOUA, T. D. Treatment of hypertension with redergam and *Rauwolfia serpentina* alkaloids (in Russian). *Ter. arkh. Moskva*, July 1957, **29**(7), 53-63.

GUPTA, J.C. and KAHALI, B. S. Comparative pharmacology of the total alkaloids of *R. serpentina*, Benth., obtained from Bengal, Bihar and Dehra Dun. *Indian J. med. Res.*, Oct. 1943, **31**(2), 215-19.

GUPTA, J.C. et al. Excretion of *Rauwolfia* total alkaloids in urine. *Indian J. med. Res.*, 1950, **38**, 68-73.

GUPTA, J.C. et al. Hypnotic effect of a resin fraction isolated from root of *R. serpentina*, Benth. obtained from Dehra Dun. *Indian J. med. Res.*, 1944, **32**(2), 183-88.

GUPTA, J.C. et al. Hypnotic principle of *R. serpentina*. *J. Amer. Pharm. Ass. (Sci. Ed.)*, 1947, **36**, 416.

GUPTA, J. C. et al. *Rauwolfia serpentina* in mental disorders. *Indian med. Gazz.*, 1943.7 **8**, 547.

GUSEVA, N.I. The treatment of hypertension disease with reserpine (in German). *Klin. Med.*, 1958, No. 3, 68-70.

GUTIERREZ, J.A.A. Reserpine in anesthetic premedication (in Spanish). *Sem. med.* (B. Aires), 28 Feb. 1957, **110**(9), 297-299.

HAAS, K. B. *Rauwolfia serpentina* toxic for dogs. *North Amer. Vet.*, Aug. 1955, **36**, 658.

HAASE, H. J. Experimental analysis of motor system in chorea patients treated with reserpine (in German). *Nervenarzt*, 20 Feb. 1957, **28**(2), 49-53.

HACKSTEIN, F.G. Limitations of treatment of Huntington's chorea and double athetosis with reserpine (in German). *Nervenarzt*, 20 June 1958, **29**(6), 274-276.

HAFKENSCHIEL, J. H. and SELLERS, A. M. Intravenous reserpine in patients with essential hypertension. *Ann. N. Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 54-60.

HAFKENSCHIEL, J.H. et al. Preliminary observation on the effects of parenteral reserpine on cerebral blood flow oxygen and glucose metabolism and electroencephalograms of patients with essential hypertension. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 78-84.

HAHN, L. On the therapy of arterial hypertension (in German). *Hippokrates* (Stuttgart), 15 Apr. 1954, **25**(7), 218-22.

HAID, B. Facilitation of anesthesia with artificial hypotension by means of *Rauwolfia*-methonium preparations (in German). *Anaesthesist* (Berlin), Jan. 1958, **7**(1), 20-23.

HAKIM, R.A. Use of *Rauwolfia* in neuro-psychiatric disorders. *Proc. 6th Gujarati Saurashtra Provincial Conf.*, Baroda, 1953.

HALEY, T.J. and DASGUPTA, S. R. Intraventricular administration of reserpine and its metabolites in conscious cats. *Medical Project Report*, 22 Aug. 1957, 12. p. (UCLA-403). (University of Califorina School of Medicine, Atomic Energy Project, Los Angeles).

HALMAGYI, D. et al. The effect of serpasil in pulmonary hypertension. *Brit. Heart J.*, July 1957. **19**(3), 375-380.

HALPRIN, H. Reserpine for the cardiac patient. *J. med. Soc. N. J.* (Orange), 1955, **52**(12), 616-8.

HAMET, R. Some essential physiological properties of an African Rauwolfia, *R. inebrians*. *C.R. Acad. Sci.* (Paris), 1958, **247**, 2031.

HAMIED, K.A. et al. A comparative pharmacological study of the antihypertensive activity and hypnotic and sedative action of a certain fraction of *Rauwolfia serpentina* and reserpine. *Indian J. Pharm.*, 1956, **18**(6), 258-65.

HAMKE, H. *Rauwolfia* alkaloid reserpine treatment autonomic disorders (in German). *Therap. d Gegenw.*, 1955, **94**(6), 218-9.

HANAFI, M. A case of serpasil poisoning in a child one year of age. *J. Egypt. med. Ass.*, 1956, **39B** (6), 14-16.

HARDISTY, R.M. et al. Reserpine and human platelet 5-hydroxytryptamine. *Experientia*, 1956, **12**, 424-426.

HARE, E.H. et al. Reserpine in anxiety states. *Lancet*, 28 Apr. 1956, 545-547.

HARINGTON, M. (*ed.*) Hypotensive drugs. Proceedings of a symposium on hypotensive drugs and the control of vascular tone in hypertension held in London on Apr. 5-6, 1956; at the Wellcome Foundation. London, Pergamon, 1957. 232 pp. (Second sec. deals with pharmacology, incl. hydralazine and reserpine.).

HARRIS, R. Clinical use of reserpine (Serpasil) in geriatrics. *Ann. N. Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 95-106.

HARRIS, R. Effects of oral sex harmones and reserpine in elderly men. *J. Amer. Geriat. Soc.*, Apr. 1958, **8**(4), 297-305.

HARRIS, R.D. and ROWLEY, E.H. Reserpine in cerebral palsy. *J. Pediat.*, Oct. 1956, **49**(4), 398-400.

HARRIS, T.H. Depression induced by *Rauwolfia* compounds. *Amer. J. Psychiat.*, Apr. 1957, **113** (10), 950.

HASSALL, C.H. Medicinal products from tropical plants. *Mfg. Chem.*, 1955, **26**(11), 494-96.

HASSE, H.J. Psychiatric experience with megaphen (Largactil) and *Rauwolfia* alkaloid Serpasil with special reference to Parkinson's psychomotor syndrome (in German). *Nervenarzt*, 1955, **26**(12), 507-10.

HASTERT, F. and DANILLON, P. Treatment of 100 mental patients with reserpine; clinical results and study by a method susceptible to eliminating secondary effects (in French). *Pr. med.*, 31 Aug. 1957, **65**(63), 1418-1421; *Bull Soc. sci. med.* (Luxembourg), Dec. 1957,51-63.

HAUCK, P. et al. The effects of reserpine on psychotic patients of varying degrees of illness: a pilot study. *J. clin. Psychol.*, Apr. 1957, **13**(2), 188-189.

HAUSER, A. Trials of hypotonic drugs on hypertonic pregnancy toxemias (in German). *Schweiz. med. Wschr.*, 24 July 1954, **84**(30), 845-50.

HAUSER, G. A. and BAUM GARTNER, R. Investigation of the renal effect of hypotensive pregnancy toxemias (in German). *Gynaecologia* (Basel), Apr. 1957, 275-285 (includes reserpine).

HAUSER, A. and WENNER, R. Serpasil in the management of climacteric dysfunction (in German). *Gynaecologia* (Basel), Nov. 1956, **142** (5), 300-303.

HARVALD, B. *Rauwolfia serpentina* alkaloids in therapy of hypertension (in Danish). *Ugeskr. Laeg.*, 5 May 1955, **117**(18), 579-80.

HARWOOD, C.T. and MASON, J.W. Acute effects of tranquilizing drugs on the anterior pituitary -ACTH mechanism. *Endocrinology*, Feb. 1957, **60**(2), 239-246 (includes reserpine).

HAVERBACK, B.J. et al Cumulative effect of small doses of reserpine on serotonin in man. *Fed. Proc.*, Mar. 1956, **15**, 434-435 (abstract).

HAVERBACK, B.J. et al. The effects of reserpine and chlorpromazine on gastric secretion. *Amer. J. med. Sci.*, Dec. 1955, **230**(6), 601-4.

HAVERBACK, B.J., et al. Effect of serotonin (5-hydroxytryptamine) and related compounds on gastric secretion and intestinal motility in the dog. *Gastroenterology*, June 1957, **32**(6), 1058-1065 (includes reserpine).

HAVERBACK, B.J. et al. Serotonin changes in platelets and brain induced by small daily doses of reserpine; lack of effect of depletion of platelet serotonin on hemostatic mechanisms. *N. Engl. J. Med.*, 21 Feb 1957, **256**(8), 343-345.

HEFLICH-PIATKOWSKSA, H. Assay with largactil and serpasil in hyperkinetic choreatic syndromes (chorea chromica progressive) with psychotic manifestations (in Polish). *Neurol. S.C. polska*, May - June 1957, **7** (3), 403-408.

HEIM, F. et al. Relation between functions and metabolism of central nervous system after the administration of reserpine (in German). *Arzneimittel Forschung*, Apr. 1958, **8**(4), 216-219.

HEINRICH, M. Effects of some centrally acting drugs on "treadmill" activity of mice exposed to ether. *Fed. Proc.*, Mar. 1957, **16**, 306 (abstract: includes reserpine).

HEINTZ, R. and LOSSE, H. The effectiveness and mode of operation of the alkaloids from *R. serpentina* in chronic arterial hypertension. *Dtsch. med. Wschr.*, 24 Sept. 1954, **79**(39), 1448-51.

HENDLEY, C.D. et al. Effects of meprobamate (Miltown), chlorpormazine, and reserpine on behaviour in the monkey. *Fed. Proc.*, Mar. 1956, 436 (abstract).

HENSEL, L. Serpasil, an alkaloid of *R. serpentina*, in therapy of hypertension (in German). *Schweiz. med. Wschr.*, 28 Nov. 1953, **83**(48), 1162-6.

HERBENUAL, R. et al. Alkaloids of *R. serpentina* in the treatment of arterial hypertension (in French). *Pr. med.*, 19 May 1954, **62**(36), 759-60.

HERTTING, G. and HORNYKIEWICZ, O. Effect of cortisone on adrenal cortex hypertrophy induced by reserpine (in German). *Acta endocr.* (Kbh.), Oct. 1957, **26**(2), 204-208.

HES, J.P. and BRACHA, S. The influence of reserpine on a disturbed male ward and a method for assessing this. *J. ment. Sci.*, July 1956, **102** (428), 546-549.

HES, J. P. and BRACHA, S. Reserpine in psychiatric treatment (in Hebrew). *Harefuah*, 2 Sept. 1956, **51**(5), 101-106.

HESS, R. Preliminary electroencephalographic findings in serpasil therapy (in German). *Schweiz. med Wschr.*, 7 May 1955, **85**(19), 442-3.

HESS, S.M. et al. Persistence of reserpine action after the disappearance of drug from brain. Effect on serotonin. *J. Pharmacol.*, 1956, **118**, 84.

HEYDECKE, K. H. Hypertension management in Los; experience with Serpatonil (in Swedish). *Svenska Lakartidn.*, 19 Oct. 1956, **53**(42), 2754-2755.

HICKERSON, G. X. et al. Reserpine in acute psychotic states; report of a controlled study. *J. nerv. ment. Dis.*, Dec. 1956, **124**(6), 614-617.

HILDEBRAND, H.J. Experiences in the treatment of mentally sick with serpasil (in German). *Munch. med. Wschr.*, 17 Aug. 1956, **98**(33), 1093-1096.

HILDEN, T. et al. Fatal pulmonary changes during medical treatment of malignant hypertension (in Danish). *Nord. med.*, 6 Mar. 1958, **59** (10), 353-356.

HILDEN, T. et al. Hydrallazine and reserpine in the treatment of hypertension (in Danish). *Ugeskr. Laeg.*, 1956, **118**, 1157-1164.

HILDEN, T. et al. Reserpine therapy of hypertension; preliminary result (in Danish). *Ugeskr. Laeg.*, 5 May 1955, **117**(18), 572-5.

HIMBERT, J.A. Treatment of angina pectoris with *Rauwolfia serpentina* (in French). *Sem. med. profes.* (Paris), 22 Jan. 1957, **33**(3), 120.

HIMWICH, H.E. New psychiatric drugs. *Sci. Amer.*, Oct. 1955, **193**, 80-82 (including reserpine).

HIMWICH, H.E. (*ed*).Tranqilizing drugs. (American Association for the Advancement of Science, Symposium Vol. 46). Washington, 1956. 205 pp. (incl. "Comparative study of reserpine, 11-desmethoxyreserpine and *Rauwolfia* alkaloids in treatment of schizophrenia", by W.J. Gallagher & others; "Management of side effects in reserpine and combined reserpine-chlorpromazine treatment", by N.S. Kline & others; "Combined reserpine-chlorpromazine therapy in highly disturbed psychotics" by W. Tuteur & D. Lepson; "A critique of chlorpromazine and reserpine therapy", by F.J. Ayd).

HOCH, P. H. Experimental psychiatry. *Amer. J. Phychiat.*, Apr. 1955, **111**(10), 787-90.

HOCHT, H. Combination drug with *Rauwolfia* and its effect on increased blood pressure (in German). *Munch. med. Wschr.*, 13 Aug. 1954, **96** (33), 923-4.

HODGKINSON, R. Effects of reserpine on hypertensive patients over a period of two years. *Brit. Heart J.*, 1956, **18**, 523-528.

HOFF, H. Advantages and disadvantages of treatment with chlorpromazine and serpasil (in French). *Encephale*, 1956, **45**(4), 352-358.

HOFFMANN, C.R. Serpasil in the treatment of peptic ulcer disease with psychogenic etiology. *Amer. J. Gastro-Ent.*, Feb. 1958, **29**(2), 187-193.

HOFFMAN, J.L. and KONCHEGUL, L. Clinical and psychological observations on psychiatric patients treated with reserpine: a preliminary report. *Ann N. Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 144-9.

HOHNLOSER, E. and RENNER, D. *Rauwolfia* alkaloids in the treatment of cardiovascular diseases (in German). *Med. Klin.*, 29 Mar. 1957, **52**(13), 510-513.

HOHNLOSER, E. and RENNER, D. Investigations of the mechanism of action of *Rauwolfia* akaloids in therapy of hypertension and circulatory heart diseases (in Portuguese). *Rev. bras. med.*, Mar. 1958, **15**(3), 166-172.

HOLECEK, V. et al. Effect of serpasil on anti-diuretic hormone secretion (in Czech.) *Cas. Lek. ces.*, 23 Aug. 1957, **96** (33-34), 1060-1062.

HOLLANDER, W. and JUDSON, W.E. Electrolyte and water excretion in arterial hypertension. II. Studies in subject with essential hypertension after antihypertensive drug treatment. *Circulation*, Apr. 1958, **17**(4), 576-582.

HOLLANDER, W. et al. Reserpine in the treatment

of hypertension; a note on the relative dosage and effects. *New Eng. J. Med.*, 18 Mar. 1954, **250**(11), 477-8.

HOLLISTER, L.E. Allergic reactions to tranquilizing drugs. *Ann. intern. Med.*, 1958, **49**, 17-29 (includes reserpine).

HOLLISTER, L.E. Hematemesis and melena complicating treatment with *Rauwolfia* alkaloids. *Arch. intern. Med.*, Feb. 1957, **99** (2), 218-221.

HOLLISTER, L.E. Tranquilizing drugs and the generalist. *Med. Times* (Great Neck), Oct. 1956, **84**(10), 1021-1026 (includes reserpine).

HOLLISTER, L.E. et al. Chlorpromazine alone and with reserpine; use in the treatment of mental diseases. *Calif. Med.*, Sept. 1955, **83**(2), 218-21.

HOLLISTER, L.E. et al. Treatment of chronic schizophrenic reaction with reserpine. *Ann N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 92-100.

HOLT, E.K. et al. Clinical comparison of Raudixin and Raused in chronic mental illness. *Dis. nerv. Syst.*, 1955, **16**(7), 222-23.

HOLTZ, P. et al. Effect of monoaminooxidase inhibition on the effects of reserpine on the adrenal medulla (in German). *Arch. exp. Path. Pharmak.*, 1957, **231**(4), 361-372.

HOLTZ, P. et al. Effect of reserpine; iproniazid and biogenic amines on evipan narcosis (in German). *Arch. exp. Path. Pharmak.*, 1957, **231** (4), 333-348.

HOLZHAUER, H. and KNOBLOCH, H. Extract from olive leaves in ambulatory treatment of hypertension combined with *Rauwolfia* and *Veratrum* alkaloids (in German). *Munch. med. Wschr.*, 31 Aug. 1956, **98**(35), 1142-1147.

HOLZHAUER, M. and VOGT, M. Deperession by reserpine of the noradrenaline concentration in the hypothalmus of the cat. *J. Neurochem.* (London), 1956, **1**(6), 8-11.

HOMOLA, D. Our experience with therapy of hypertension with *Rauwolfia* alkaloids (in Czech.). *Vnitrni Lekarstvi* (Brono), June 1955, **1**(6), 462-7.

HONHEISER, G. The effects of *Rauwolfia* total extract on the various forms of of arterial hypertension (in German). *Med. Klin.*, 11 Mar. 1955, **50** (10), 400-4.

HOOBLER, S.W. Treatment of hypertension. *Amer. J. Med.*, Aug. 1954, **17** (2), 259-70.

HOOD, B. et al. Medical treatment of hypertension (in Swedish). *Senska Lakartidn.*, 28 Oct. 1955, **52** (43), 2617-32.

HOPKINS, J. Diuretics, *Rauwolfia* and other hypotensive agents. Derivatives of cortisone. *Mfg. Chem.*, Apr. 1958, **29**(4).

HORENSTEIN, S. Reserpine and chlorpromazine in hyperactive mental defectives. *Amer. J. ment. Defic.*, Jan. 1957, **61** (3), 625-629.

HORIMA, A. A comparison between combined reserpine - chlorpromazine and chlorpromazine therapies in psychiatry. *Acta psychiat.* (Kbh.), 1956, **31** (4), 437-447.

HORIMA, A. Observations on combined chlorpromazine, reserpine and insulin coma therapy (in Finnish). *Duodecim*, 1956, **72**(11), 948-985.

HORIMA, A. and HORIMA, M. Effect of chlorpromazine and reserpine on wound healing in the white rat (in Finnish). *Ann. Med. exp. Fenn.*, 1957, **35**, 150-154.

HORMIA, M. et al. Effect of chlorpromazine and reserpine on liver parenchyme in the white rat. *Ann. Med. exp. Fenn.*, 1957, **35**(3), 316-323.

HORITA, A. A vasopressor response to reserpine in the cocainized dog. *J. Pharmacol.*, Apr. 1958, **122** (4), 474-479.

HORWITZ, B.S. and WANG, S.C. Reserpine effect in medullary vasomotor mechanism of the cat. *Fed. Proc.*, Mar. 1956, **15**, 439-430 (abstract).

HUBNER, K. et al. Clinical studies on the treatment of hypertension with reserpine (in German). *Dtsch. med. Wschr.*, 7 Jan. 1955, **80** (1), 47-54.

HUCHTEMANN, K. and PFLUGFELDER, G. Serpasil therapy in psychiatry (in German). *Schweiz. med. Wschr.*, 25 June 1955, **85**(26), 627-30.

HUGHES, F. BARBARA. et al. Serotonin storage mechanism and its interaction with reserpine. *Experientia*, May 1958, **14** (5), 178-179.

HUGHES, W. et al. Reserpine alone and in combination with hydralazine and hexamethonium in the treatment of hypertension. *Fed. Proc.*, 1954, **13**, 368.

HUGHES, W.M. et al. Parenteral reserpine in treatment of hypertensive emergencies. *Arch. intern. Med.*, Apr. 1955, **95**(4), 563-77.

HUGHES, W.M. et al. Reserpine (Serpasil) in the treatment of hypertension. *Ann. med. Sci.* (Phila.), July 1954, **228**(1), 21-35.

HUGHES, W.M. et al. Treatment of hypertension with oral reserpine alone and in combination with hydralazine or hexamethonium. *Amer. J. med. Sci.*, 1955, **229**(2), 121-34.

HULET, W.H. and PERARA, G.A. Effect of serotonin on renal excretion of sodium, possible reaction to *Rauwolfia* action. *Proc. Soc. exp. Biol.* (N.Y.), Jan. 1956, **91** (1), 512-514.

HURXTHAL, L.M. et al. Observations on the effect of reserpine; *Rauwolfia serpntina*, *Rauwolfia heterophilia* and *Rauwolfia canescens* in arterial hyper-

tension; preliminary report. *Lahey clin. Bull.*, Oct.-Dec. 1956, **10**(2), 34-40.

HUSSAR, A.E. Complications of chlorpromazine and reserpine therapy. *GP.*, May 1957, **15** (5), 85-93.

HUSSAR, A.E. and BRUNO, E. Acute duodenal ulcer associated with reserpine therapy. *Gastroenterology*, 1956, **31**, 500-504.

Hypertension (Editorial). *J. Canad. med. Ass.*, 1953, **68**, 287 (incl. ref. to *R. serpentina*).

ILIC, A. et al. Serpasil therapy of schizophrenia (in Serbo-croat.). *Srpski arch. celok. lek.*, Sept. 1957, **85**(9), 943-954.

ILLIG, R. The effect of reserpine (Serpasil) on blood-pressure waves. III. Effect on hypertension (in German). *Helv. med. acta.*, 1955, **22** (6), 607-625.

INDERSINGH. Reserpine in hypertention. *Brit. med. J.*, 1955, No. 4917, 813.

International Conference in Paris on chlopromazine and neuroleptic drugs in psychotherapy (in French). *J. Med. Lyon*, 5 Feb. 1956, **37**(866), 103-5.

ISAJA, M. Serpasil in the therapy of mental diseases (in Italian). *Rass. Studi. psichiat.*, July-Aug. 1957, **46**(4), 584-596.

ISBELL, H. Effect of chlorpromazine, reserpine and 'Frenquel' on LSD reaction. *Fed. Proc.*, Mar. 1956, **15**, 442-443 (abstract).

ISBELL, H. and LOGAN, C.R. Studies on the diethylamide of lysergic acid (LSD-25). II. Effects of chlorpromazine, azacyclonol, and reserpine on the intensity of the LSD reactions. *Arch. Neuerol. Psychiat.* (Chicago), Apr. 1957, **77**(4), 350-358.

ISWARIAH, V. et al. Pharmacological study and clinical observations on *Rauwolfia* alkaloids (*R.* S.51) a hypotensive agent. *Indian J. med Sci.*, 1954, **8**(5), 257-71.

ITSU SHIMA, YUICHIRO. Pharmacological and clinical reviews on *Rauwolfia* alkaloids. *Shinyaka to Rinsho.*, 1955, **4**, 819-822.

IULIANI, G. Effect of reserpine on adrenal cortex function (in Italian). *Rass. int. clin Terap.*, 31 July 1957, **37**(14), 639-642.

IULIANI, G. and IACONO, A. Effect of reserpine on peripheric circulation in normal and hypertensive subjects (in Italian). *Rass. int. clin. Terap.*, 15 Feb. 1957, **37** (3), 94-96.

IVANCIC, R. The treatment of arterial hypertension with the modern hypotensive agents: Neresol and Serpasil. *Lijecnicki Vjesnik* (Zagreb), 1954, **76**(9-10), 481-7.

JACOBSEN, ERIK. The pharmacological classification of central nervous depressants. *J. Pharm.* (Lond.), May 1958, **10**(5), 273-294 (includes reserpine).

JACONO, A. and GALLO, B. Effect of reserpine on glucose exchange. *Boll. Soc. ital. Biol., sper.*, 1956, **32**, 643-645.

JACONO, A. and JULIANI, G. Clinical observations on the association of reserpine with phenylpiperidyl-2 methyl acetate HCL (ritalin) in arterial hypertension (in Italian). *G. clin. med.*, July 1956, **37** (7), 1010-1015.

JAHN, H. Combined administration of dihydrazinophthalazine- *R. serpentina*, Ipharon, in hypertension (in German). *Med. Klin.*, 11 Feb. 1955, **50**(6), 249-50.

JAHN, H. and LEUTSCHAFT, R. Experiences in therapy of hypertension with *R. serpentina* preparation. Rivadescin and reserpine (in German). *Med. Klin.*, 27 Nov. 1953, **48** (48), 1779-9.

JAHRMARKER, H. Cardio- vascular effects of *Rauwolfia* alkaloids in ambulant treatment and in the cold blood pressure test (in German). *Z. Immun. Forsch.*, 1955, **153** (1), 89-102.

JANNARONE, G. Pruritus ani; chemical aspects of treatment with *Rauwolfia serpentina*, Benth. (in Italian). *Gazz. med. ital.* (Milano), Feb. 1957, **116**(2), 79-83.

JANSSEN, P. A note on the physiochemical properties of *Rauwolfia* alkaloids. *Acta pysiol. Pharmacol.* (Amsterdam), Aug. 1955, **4**(2), 183-6.

JENNEY, E.H. Changes in convulsant threshold after *R. serpentina*, reserpine and veriloid. *Fed. Proc.*, 1954, **13**, 370.

JENSEN, E.S. Serpasil therapy in a hospital for the mentally deficient (in Danish). *Ugeskr. Laeg.*, 10 Nov. 1955, **117**(45), 1463-5.

JENSEN, E.S. Serpasil treatment in a hospital for the mentally deficient. *Acta psychiat.* (Kbh.), 1957, **32**(1), 17-19.

JOHN, E.R. et al. Differential effects of reserpine on conditioned responses on cat. *Science*, 3 Jan. 1958, **127**(3283), 25-26.

JOHN, E.R. et al. Differential effects on various conditional responses in cats caused by intraventricular and intramascular injections of reserpine and other substances. *J. Pharmacol.*, July 1958, **123**(3), 193-205.

JOHN, R. et al. Preliminary note on a pharmacological investigation of hypertensive action of *Rauwolfia serpentina*, Benth. *J. Amer. pharm.*

Ass. (*Sci. Ed.*), 1953, **42**, 324.

JOHNSTON, A.H. and MARTIN, C.H. The clinical use of reserpine and chlorpromazine in the care of the mentally deficient. *Amer. J. ment. Defic.*, Sept. 1957, **62**(2), 292-294.

JOINER, C. and KAUNTZE, R. Arterial hypertension treated with *Rauwolfia serpentina* and veratrum viride. *Lancet*, 29 May 1954, **266**, 1097-9.

JONES, H.H. Reversible depression and Parkinsonian occurring during treatment of hypertension with *Rauwolfia*. *J. Okla. med. Ass.*, Nov. 1955, **48**(12), 380-1.

JOST, F. and KATZELBERGER, K. Course of treatment with reserpine in clinical practice in psychiatry (in German). *Wien. med. Wschr.*, 15 Feb. 1958, **108**(7), 154-156.

JURGENS, E.G. A comparison of whole root extract from *Rauwolfia* and reserpine on the blood pressure of dogs. *Acta physiol. Pharmacol.*, Dec. 1956, **5**(2), 247-248.

KADATZ, R. Pharmacological properties of the *Rauwolfia serpentina* alkaloid and of a reserpine and *serpentina* (vilescon) (in German). *Arzneimittel Forschung*, 1955, **5**(12), 715-9.

KADATZ, R. and POTZSCH, E. Pharmacological properties of the new analeptic 1-phenyl-2-pyrrolidine-pentane (in German). *Arzneimittel Forschung*, 1957, **7**, 344-349 (includes reserpine-antagonisms).

KAERN, M. and TONNESEN, M. On the hydrolysis of reserpine (in Danish). *Dansk. Farm.*, Supp. 2, 22 Sept. 1956, 182-94.

KAHLER, H.J. New *Rauwolfia* alkaloids with hypotensive effect in pheochromocytoma (in German). *Med. Klin.*, 14 Mar. 1958, **53**(11), 423-427.

KALINOWSKY, L.B. Chlorpromazine and reserpine, and their relation to other treatments in psychiatry. *Proc. Rudolph Virchow Soc.*, 1956.

KANDIC, B. Treatment of mental disorders with reserpine (in Serbo-croat.). *Vojno-sanit. Pregl.*, Jan.-Feb. 1957, **14**(1-2), 44-47.

KANTARDJIAN, A. Preliminary communication of the use of reserpine (Serfin) in psychiatry disorders. *J. Fac. Med.* (Baghdad), 1956, **20** (1-2), 7-10.

KAPLAN, M.R. and PILGER, I.S. The effect of *Rauwolfia serpentina* derivatives on intraocular pressure. *Amer. J. ophthal.*, Apr. 1957, **43**(4), Part I, 550-574.

KAPUR, R.D. Pharmacological action of alkaloids of *R. serpentina*. II. Total alkaloidal extracts of Bihar and Dehra Dun varieties. *Indian J. med. Res.*, 1948, **36**, 57-60.

KAPUR, R.D. *Rauwolfia serpentina* in hypertension. *J. Indian med. Ass.*, 1942, **11**, 198.

KAR, AMIYA B. and BOSCOTT, R.J. Preliminary investigations on the influence of reserpine and lysergic acid diethylamide (LSD), on the thyroid of the rat. *Indian J. pharm.*, 1956, **18**(7), 296-300.

KASS, I. and BROWN, E.C. Treatment of hypertensive patients with *Rauwolfia* compounds and reserpine; depressive and psychotic changes. *J. Amer. med. Ass.*, 17 Dec. 1955, **159**(16), 1513-6.

KATO, R. et al. More on the relation between electroshock and reserpine (in Italian). *Boll. Soc. ital. Biol. sper.*, 31 Mar. 1958, **34**(6), 248-250.

KAWAI, SHIGEHIRA et al. Pharmacological and clinical reviews on *Rauwolfia* alkaloids. *Shinyaku to Rinsho*, 1955, **4**, 239-242.

KAYSER, F. Poisoning with reserpine in a small child. (in German). *Arch. fur Toxikologie*; *fuhner-Wielands Sammlung von Vergiftungsfallen* (Berlin), 1956, **16**(2), 97-9.

KEDRA, M. Serpasil in allergy (in Polish). *Pol. med. Wkly.*, 25 Nov. 1957, **12**(47), 1801-1805.

KEHL, R. et al. Effect of reserpine during various stages of gestation in rabbit (in French). *C.R. Soc. Biol.* (Paris), 1956, **150**(12), 2196-2199.

KEHL, R. et al. Experiments on the effect of reserpine on hypo-physogenital activity (in French). *C.R. Soc. Biol.* (Paris), 1956, **150**(5), 981-983.

KELLER, D.L. and UMBRETT, W.W. Chemically altered "parmanent" behaviour patterns in fish and their cure by reserpine. *Science*, 1956, **124**, 407.

KELLER, D.L. and UMBRETT, W.W. Permanent alteration of behaviour in mice by chemical and psychological means. *Science*, 1956, **124**, 723-724.

KERT, M.J. et al. Clinical experiences with reserpine (Serpasil) in hypertension, a preliminary report. *Angiology*, Apr. 1955, **6**(2), 138-43.

KEYRILAINEN, T.O. et al. Effects of reserpine and chlorpromazine on the shay rats. *Ann. Med. exp. Fenn.*, 1957, **35**(4), 431-436.

KHAMBATTA, R.B. Dynamism in concepts of hypertension. *J. Paksit. med. Ass.*, 1957, **7**(6), 7-12 (incl. ref. to *Rauwolfia serp.*).

KHIBARKIS KH. KH. and STUPELIS, I.G. The use of *Rauwolfia serpentina* preparations in the combined treatment of hypertension (in Russian). *Soviet Med.*, Jan. 1958, **22**(1), 82-89.

KHIRWADKAR, M.G. Serpasil and coagulation of blood. *Indian J. med. Sci.*, 1955, **9**, 162-62.

KHITROVA, E.M. Reserpine (serpasil) therapy of hypertension in polyclinical conditions (in Russian). *Voen. med. zh.* (Moskva), May 1958, No. 5, 39-43.

KIERSZ, J. Can reserpine prevent amoria in shock? *Internat. Arch. Allergy* (Basel), 1957, **10**(6), 376-378.

KIERSZ, J. et al. Experimental observations on the effect of reserpine (Serpasil) on blood-sugar level (in Polish). *Acta physiol.* (Polon), 1957, **8**(1), 125-139.

KIERSZ, J. et al. Investigation on the influence of reserpine (Serpasil) on carbohydrate metabolism. *Arch. int. Pharmacodyn.*, 1957, **113**, 114-126.

KILLAM, E.K. et al. The effects of psychotherapeutic compounds on central afferent and limbic pathways. *Ann. N.Y. Acad. Sci.*, 14 Mar.1957, **66**(3), 784-805 (includes reserpine).

KILLAM, K.F. et al. Effect of reserpine and chlorpromazine on positive reinforcement behaviour in rats. *Fed. Proc.*, Mar. 1956, **15**, 447-448 (abstract).

KINARD, S. et al. Use of *d*-amphetamine to curb the increased appetite and over eating induced by reserpine therapy. *J. Amer. Geriat. Soc.*, Nov. 1956, **4**(11), 1073-1077.

KINROSS-WRIGHT, V. Chlorpromazine and reserpine in the treatment of psychoses. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 174-82.

KIRKPATRICK, W.L. and SANDERS, F. Clinical evaluation of reserpine in a state hospital. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 123-43.

KIROV, K. et al. Observations on serpasil therapy of psychosis (in Bulgarian). *Suvrem. med.* (Sofia), 1957, **8**(10), 39-47.

KIRPEKAR, S.M. and LEWIS, J.J. Antagonism to the actions of hydrallazine, reserpine, potassium cyanide, sodium azide and anoxia or arterial smooth muscle. *J. Pharm.* (Lond.), May 1958, **10**(15), 307-314.

KIRPEKAR, S.M. and LEWIS, J.J. Effects of reserpine and hydrallazine on isolated strips of carotid arteries. *J. Pharm.* (Lond.), 1 Apr. 1958, **10**(4), 255-259.

KIRSNER, J. D. and FORD, H. The effect of reserpine upon basal gastric secretion in man. *Arch. intern. Med.*, Mar. 1957, **99**(3), 390-400.

KISELEVA, S.K. Treatment of hypertension with serpasil (in Russian). *Klin. med., Moskva.*, Jan. 1957, **35**(1), 28-35.

KIVALO, E. et al. Response of the neurohypophysis to serotonin, reserpine, and chlorpromazine; a histological study of the neurosecretory substance in the posterior pituitary. *Ann. Med. intern. Fenn.*, 1957, **46**(4), 191-9.

KJERULF-JENSEN, K. and STURUP, H. Decrease in blood pressure after parenteral trial doses of reserpine (Serpasil), hydralazine, (Apresolin) and pentapyrrolidin (Ansolysen) in patient arterial hypertension with special reference to the value of the test as an indicator of the chemical effect in subsequent peroral prolonged treatment (in Danish). *Ugeskr. laeg.*, 4 Oct. 1956, **118**(40), 1166-1167.

KLAUER, D.F. Action of reserpine on contraction of uterus and dilatation of the cervix; preliminary report (in Spanish). *Prensa. med. argent.*, 19 Dec. 1956, **43**, 3702-3706.

KLAUER, D.F. Uterine contraction, cervical diltation and labour pain; effect of reserpine-glutethimide in 100 cases (in Spanish). *Prensa. med. argent.*, 6 Sept. 1957, **44**(36), 2784-2790.

KLAUER, D.F. et al. Hypertension and pregnancy; its treatment with reserpine (in Spanish). *Prensa. med. argent.*, 15 Feb. 1957, **44**(7), 499-504.

KLAUSGRABER, F. Progress in hypertension therapy with pure alkaloids of *Rauwolfia serpentina* (in German). *Wien med. Wschr.*, 16 Apr. 1955, **105**(15), 310-1.

KLAUSGRABER, F. *Rauwolfia serpentina* in treatment of hypertension (in German). *Wien med. Wsch.*, 6 June 1953, **103**(23), 403-1.

KLEH, J. and FAZEKAS, J.E. Effects of hypotensive agents on subjects with cerebral insufficiency. *J. Amer. Geriat. Soc.*, 1956, **4**(1), 18-23.

KLEH, J. and FAZEKAS, J.F. Use of reserpine in the hypertensive arteriosclerotic syndrome. *Amer. J. med. Sci.*, Nov. 1954, **228**(5), 560-2.

KLEINSORGE, H. and GOSSMANN, K. Flicker fusion frequency as a test method for the detection of the potentiating action of reserpine on barbiturates (in German). *Arzneimittel Forschung*, 1956, **6**, 495-496.

KLEINSORGE, H. and WITTIG, H.H. Alkaloids from *Rauwolfia serpentina* used therapeutically in hypertension (in German). *Medizinische*, 21 Aug. 1954, No. 33-34, 1086-9.

KLEINSORGE, H. and WITTIG, H.H. Indication and limitations of *Rauwolfia* therapy of cardiovascular diseases (in German). *Munch. med. Wschr.*, 20 Dec. 1957, **99**(51), 1946-1950.

KLINE, N. S. (*ed.*). Psychopharmacology. American Association for the Advancement of Science, Symposium Vol. No. 42. Washington, 1956. 175 pp. (incl.: "Clinical applications of reserpine", by N. S. Kline; "Clinical trial of reserpine in psychotic and psychoneurotic

illnesses" by A. E. Bennett; "Pharmacology of chlorpromazine, reserpine, and related drugs" by F.H. Meyers).

KLINE, N.S. Use of *Rauwolfia serpentina*, Benth. in neuropsychiatric conditions. *Ann. N.Y. Acad. Sci.*, Apr. 1954, **59**(1), 107-32.

KLINE, N.S. and SAUNDER, J.C. Reserpine in psychiatric and neurologic disorders. *Med. Clin. N. Amer.*, Mar. 1957, **41**(2), 307-26.

KLINE, N.S. and STANLEY, A.M. Use of reserpine in a neuropsychiatric hospital. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 85-91.

KLUPP, H. Pharmacological studies on yohimbic acid ethyl ester (A 38) and 4,2-(*p*-butoxyphenyl)-1,3-dioxolan-2-methyl-morphine - methobromide (Q 160) as well as the influence of these substances on reserpine action (in German). *Arzneimittel Forschung*, Aug. 1955, **5**(8), 432-6.

KNOLL, JOSEF and KNOLL, BERTA. Methods for investigating the specific depressive effects of tranquillizers on the central nervous system. (in German). *Arzneimittel Forschung*, June 1958, **8**(6), 330-33.

KNUCHEL, F. Experiments with Raucolyt in the treatment of hypertension; report (in German). *Med. Mschr. Stuttgart*, 1954, **38**, 1280.

KOBINGER, W. Differentiation between the sedative actions of 5-hydroxytryptamine and reserpine in mice by means of two stimulating substances. *Acta pharm. tox.* (Kbh.), 1958, **14**(2), 138-147.

KOBINGER, W. Reversibility of a facilitatory action of reserpine on the central nervous system, by methylamphetanine. *Experientia*, Sept. 1958, **14** (9), 337-338.

KODAHL, T. and THIEME, H. Chlorpromazine therapy in reserpine-refractory, psychotic patients (in Danish). *Nord. med.*, 16 May 1957, **57**(20), 709-713.

KOHLER, G. Influence of Rauserpol on blood pressure in surgery (in German). *Therap. d. Gegenw.*, 1955, **94**(9), 333-4.

KOHLER, U. Cardiac effect of reserpine in the clinic and in experiments (in German). *Arzneimittel-Forschung*, 10 Mar. 1957, **11**(3), p. 1/150-152.

KOHLI, J.D. and DE, N.N. Pharmacological action of rauwolscine. *Nature*, 23 June 1956, **177**, 1182.

KOHLI, J.D. and MUKERJI, B. Comparative activity of reserpine and total alkaloids of *Rauwolfia*. *Curr. Sci.*, 1955, **24**(6), 198-99.

KOHLI, J.D. and MUKERJI, B. Comparative activity of reserpine and total alkaloids of *Rauvolfia serpentina*, Benth. *Indian J. Pharm.*, 1956, **18**(7), 301-303.

KOHLI, J.D. and MUKERJI, B. Pharmacological activity of resinous residue of *Rauwolfia serpentina*, Benth. *Bull. nat. Inst. Sci. India*, 1955, No. 4, 71-74.

KOHLI, J.D. et al. Pharmacological action of rauwolscine. *Arch. int. Pharmacodyn.*, 1 May 1958, **115**(1-2), 32-42.

KOHLI, J. D. et al. Rauwolscine, pharmacological action. *Arch. int. Pharmacodyn.*, 1957, **111**, 108-121.

KOHLI, J. D. et al. Studies on the metabolism of reserpine. II. Distribution and excretion in rats. *J. sci. industr. Res.*, 1956, **15C**(7), 167-69.

KOLLERT, G. and SIEDEK, H. Combination therapy of hypertension (in German). *Wien. med. Wschr.*, 5 Jan. 1957, **107**(1), 29-32 (includes reserpine).

KOLLNER, M. Clinical experiences with the new *Rauwolfia* combination preparation—rauwopur (in German). *Dtsh. med. J.*, 15 Jan. 1957, **8**(1), 28-30.

KOLOSOV, A. V. The long-term treatment of hypertension patients with reserpine (Serpasil) under polyclinic conditions (in German). *Klin. Med.*, 1958, No. 3, 58-64.

KOLTONOW, L. Reserpine in the treatment of patients with chronic mental disease; a controlled study. *J. nerv. ment. Dis.*, Apr. 1956, **123** (4), 392-394.

KOMARNICKA, R. Serpasil (reserpine) in therapy of hypertension (in Polish). *Polsk. Arch. med. Wewn.*, 1957, **27**(2), 275-284.

KOMAROMY, J. and ERDELYI, G. Simultaneous administration of reserpine and rhodan and also of hydergine and rhodan in ambulatory therapy of hypertension (in Hungarian). *Orv. hetil.*, 20 Oct. 1957, **98**(42), 1151-1154

KONRAD, J. *Rauwolfia* alkaloids. *Prakt. Lek.* (Praha), 20 Mar. 1955, **35**(6), 136-37.

KONRAD, J. Therapy of hypertension with reserpine (Serpasil-Ciba). *Prakt. Lek.* (Praha), 20 Mar. 1955, **35**(6), 137-38.

KOPMANN, E. and HUGHES, F. W. Anxiety and learning in rats under stress-avoidance ; discrimination conditions as influenced by chlorpromazine, reserpine, and glutamate. *Experientia*, Aug. 1958, **14**(8), 301-302.

KOSTIC, P. et al. Treatment of hypertension during pregnancy and after delivery with largactil and Serpasil (in Serbo-croat.). *Srpski arch. celok. lek.*, Nov. 1956, **84**(11), 1291-1296.

KOTHARI, N. J. and RINDANI, T. H. Effect of reserpine-free extract of *Rauwolfia serpentina* on stress-induced activation of adrenal cortex. *Arch. int. Pharmacodyn.*, 1956, **105**(1-2), 68-72.

KOTHARI, N. J. et al. Effect of reserpine free extract of *Rauwolfia serpentina* on the action of ACTH and hydrocortisone in man. *Arch. int. Pharmacodyn.*, 1957, **111**, 293-295.

KOVITZ, B. et al. A comparison of chlorpromazine and reserpine in chronic psychosis. *Arch. Neurol. Psychiat.* (Chicago), Nov. 1955, **74**(5), 467-71.

KOZLOWSKI, L. Mentally disturbed patients; a study of low dosage Serpasil. *Med. Times* (Great Neck), Nov. 1956, **84**(11), 1219-1224.

KRAMER, K. et. al. Adrenolytic and analeptic effects of *Rauwolfia serpentina* extracts (in German). *Klin. Wschr.*, 15 Oct. 1953, **31**(39-40), 992-5.

KREJCI, F. and WATSCHINGER, B. Effects of *Rauwolfia* alkaloids on the nasal mucosa (in German). *Wein Klin. Wschr.*, 3 Sept. 1954, **66**(35-36), 707-8.

KRIVOY, W. A. Actions of chlorpromazine and of reserpine on spinal reflex activity in the cat. *Proc. Soc. exp. Biol.* (N.Y.), Oct. 1957, **96**(1), 18-20.

KROGSGAARD, A. R. Blood pressure reduction due to reserpine administration (in Danish). *Ugeskr. Laeg.*, 1956, **118**, 1164-1165.

KROGSGAARD, A. R. Effect of reserpine on the electrolyte and fluid balance in man (in Danish). *Acta med. scand.*, 1957, **159**, 127.

KROGSGAARD, A. R. Effect of reserpine on human gastric secretion (in Swedish). *Nord. med.*, 15 Dec. 1955, **54**(50), 1851-3.

KROGSGAARD, A.R. Hypotensive effect of reserpine compared with phenobarbital and placebo. *Acta med. scand.*, 5 June 1957, **157**(5), 379-385.

KROGSGAARD, A. R. Reserpine and gastric secretion in man (in Danish). *Acta med. scand.*, 1957, **157**, 1-11.

KROGSGAARD, A. R. Reserpine (Serpasil) a hypotensive drug; review. *Ugeskr. Leag.*, Aug. 1954, **116**(33), 1185-91.

KRONEBERG, G. Pharmacological bases of the reserpine-mephenamine combination (phasein) (in German). *Nervenarzt*, 20 June 1958, **29**(6), 266-268.

KRONEBERG, G. Pharmacology of *Rauwolfia serpentina* (in German). *Arzneimittel Forschung*, 1957, **7**, 527-528.

KRONEBERG, G. Pharmacology of *Rauwolfia*. *Planta Med.*, 15 Dec. 1957, **5**(56), 156-165.

KRONEBERG, G. Rescinnamine, the second sedative alkaloid of *R. serpentina* (in German). *Arzneimittel Forschung*, 1956, **6**(10), 579-83.

KRONEBERG, G. Pharmacology of the *Rauwolfia* alkaloid raubasine (δ-yohimbine-ajmaline). *Arch. exp. Path. Pharmak.*, 1958, **233**, 72-97.

KRONEBERG, G. and ACHELIS, J.D. Adrenolytic and sympatholytic effect of two new *Rauwolfia* alkaloids, raupin and raubasin, on blood pressure and on nictitating membrane of cat (in German). *Arzneimittel-Forschung*, 1954, **4**(4), 270-3.

KRONEBERG, G. and SCHUMANN, H.J. Adrenaline secretion an adrenalin impoverishment of the adrenal glands of rabbits after reserpine (in German). *Arch. exp. Path. Pharmak.*, 1958, **234**(2), 133-146.

KRONEBERG, G. and SCHUMANN, H. J. Effect of reserpine on the adrenal medulla (in German). *Arch. exp. Path. Pharmak.*, 1957, **232**(1), 278-279.

KRONEBERG, G. and SCHUMANN, H. J. Effect of reserpine on the hormone content of the adrenal medulla (in German). *Arch. exp. Path. Pharmak.*, 1957, **231**(4), 249-360.

KRONEBERG, G. and SCHUMANN, H.J. The influence of *Rauwolfia* alkaloids, reserpine, rescinnamine, and canescine on the catecholamine content of the adrenal medulla. *Arzneimittel Forschung*, 1957, **7**, 379-280.

KRONEBERG, G. et al. Combined effects of the *Rauwolfia* alkaloids, reserpine and raubasine (in German). *Arch. exp. Path. Pharmak.*, 1956, **228**(1-2), 169-71.

KROWCZYNSKI, L. Reserpine (Serpasil) alkaloid of *Rauwolfia serpentina* (in Polish). *Pol. med. Wkly.*, 30 May 1956, **10**(22), 728-32.

KRUK, M. Perforation of duodenal ulcer as a complication of reserpine therapy (in Polish). *Pol. med. Wkly.*, 29 Apr. 1957, **12**(18), 690-692.

KRYAER, O. and FUENTES, J. Changes of heart rate caused by direct cardiac action of reserpine. *J. Pharmacol.*, 1958, **123**, 145-152.

KRYAER, O. and FUENTES, J. Chronotropic cardiac action of reserpine. *Fed. Proc.*, Mar. 1956, **15**, 449 (abstract).

KUCERA, O. Reserpine therapy of children with behaviour disorders caused by encephalopathy (in German). *Z. Kinderpsychiat.*, June 1957, **24**(3), 75-84.

KUCERA, V. J. Ambulatory treatment of hypertension with *Rauwolfia* alkaloids (in Czech.). *Cas. Lek. cesk.*, 2 Aug. 1957, **96**(32), 1013-1016.

KUHNS, K. et al. Comparative clinical studies on the effect of hydrazinophthalazine and *Rauwolfia* alkaloid reserpine on the blood

presssure (in German). *Klin. Wschr.*, 1 Oct. 1954, **32**(37-38), 930-5.

KUNTZMAN, R. et al. Biochemical effect of reserpine on serotonin binding sites. *Fed. Proc.*, Mar. 1956, **15**, 1450 (abstract).

KUPPERMAN, H. S. et al. Effect of reserpine, with or without hormonal therapy upon the female climacteric. *J. Amer. Geriat. Soc.*, 1956, **4**(2), 150-6.

KUSCHKE, H. J. and FRANTZ, J. Hyperglycemic effect of reserpine (in German). *Arch. exp. Path. Pharmak.*, 1955, **224**(3), 269-74.

KUSCHKE, H. J. and GRUNER, H. Reserpine as thyroxin-antagonist (in German). *Klin. Wschr.*, 15 June 1954, **32**(23-24), 563-4.

KUSKE, F. A. Treatment of arterial hypertension with *Rauwolfia* alkaloids and hydrazinophthalazin (in German). *Therap. d. Gegenw.*, 1955, **94**(11), 410-3.

KUWANA, SHOJI. Effects of reserpine and serpentine on the electroencephalogram of rabbits. *Acta med. Biol.*, 1956, **4**, 21-29.

KUWANA, SHOJI. The effects of reserpine and serpentine on the EEG in rabbits. *Folia Pharmacol. Japonica*, 20 May 1956, **52**(3), 317-321.

KYNEUR, F. J. Psychiatric consequences of *Rauwolfia* therapy. *Med. J. Aust.*, 17 Aug. 1957, **2**(7), 241-242.

LA BARRE, J. and DESMAREZ, J. J. Hypersecretion phenomena and manifestations of stomach ulcer appearing in reserpine-treated rat (in French). *C.R. Soc. Biol.* (Paris), 1957, **151**(7), 1451-1452.

LA BARRE, J. and GILLO, L. Action of non-reserpine extracts of *Rauwolfia vomitoria* on the gastric function. *C. R. Soc. Biol.* (Paris), 1957, **151**, 1978.

LA BARRE, J. and HANS, M. J. Effect of non-reserpine extracts of *Rauwolfia vomitoria* on blood pressure of the chloralized cat. *C. R. Soc. Biol.* (Paris), 1957, **151**, 1981.

LA BARRE, J. and LIEBER, C.H. Effect of barbiturates on post-misulin and post-reserpine gastric hypersecretion in the dog. *C.R.Soc. Biol.* (Paris), 1957, **151**,1761-1763.

LA BARRE, J. and LIEBER, C.S. Effect of reserpine, on gastric secretion in dog (in French). *C.R. Soc. Biol.* (Paris), 1957, **151**(7), 1449-1451.

LA BARRE, J. and LIEBER, Ch. S. Effects of non-reserpine extracts on *Rauwolfia vomitoria* on the gastric secretion of the dog. *C.R. Soc. Biol.* (Paris), 1957, **151**, 1979.

LABHARDT, F. General and psychiatric points of view on the treatment with autonomic drugs (in German). *Dermatologica* (Basel), Oct. 1955, **111**(4), 177-85.

LACKNER, H. and LINES, G.M. Rauwiloid in hypertension. *S. Afr. med. J.*, 26 Oct. 1957, **31**(43), 1085-1093.

LAFON, R. et al. Comparative effects of the intravenous injections of serotonin and reserpine; neurovegetative and electro-encephalographic psychometric study (in French). *Ann. med. Psychol.*, **114**, Oct. 1956, **2**(3), 463-466.

LAFON, R. et al. Psychologic examination of patients treated by RP 4560 (chlorpromazine and reserpine) (in French). *Encephale*, 1956, **45**(4), 996-999.

LAFON, R. et al. Vegetative effects of chlorpromazine and reserpine in man (in French). *Therapie* (Paris), 1957, **12**(3), 361-370.

LAK, H. et al. Notes on a case of hyperthyroidism treated with Serpasil (in Rumanian). *Med. int.* (Bucuresti), Oct. 1956, **8**(6), 1075-1077.

LAMBERT, P.A. et al. Twenty-four chronic mental patients treated successively with prolonged chlorpromazine therapy followed by reserpine, comparative results; superior effects of reserpine in hypomanic syndromes (in French). *Ann. med. psychol.*, 115, July 1957, **2**(2), 284-290.

LAMBIC, I. Ambulatory treatment of chronic arterial hypertension with pendiomide and with serpasil pendiomide (in Serbo-Croat.). *Srpski. Arch. celok. lek.*, Mar. 1957, **85**(3), 343-348.

LAMBROS, V.S. The use of reserpine in certain neurological disorders: organic convulsive states, enuresis, and head injuries. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 211-4.

LAMMLE. The blood pressure reducing effect of *Rauwolfia serpentina* (in German). *Arztl. Praxis*, 1954, No. 20, 2.

LANDESMAN, R. et al. Reserpine in toxemia of pregnancy. *Obst. Gynec.* (N.Y.), Apr. 1957, **9**(4), 377-383.

LANDGREBE, B. Experience with reserpine (Sedaraupin) in a psychiatric hospital (in German). *Medizinische*, 9 Apr. 1955, No. 15, 610-3.

LANGEJAN, M. and LIEFERINK, H.F.L. Detection of hydrolysis products of reserpine. *Pharm. Weekbl.*, 1955, **91**, 847-750.

LANGEMANN, H. and GOERRE, J. Suppression of hydroxyindole-acetic acid excretion in urine after reserpine administration in humans; with special consideration to carcinoid syndrome

in German). *Schweiz. med. Wschr.*, 25 May 1957, **87**(21), 607-611.

LANGFITT, T.W. et al. Relation between cerebral synoptic actions of mescaline, indoles and tranquilizers. *Fed. Proc.*, Mar. 1956, **15**, 451-452. (Abstract: includes reserpine).

LAPINSOHN, L.I. Ritalin and serpasil in the treatment of Parkinson's disease. *Dis. nerv. Syst.*, Oct. 1956, **17**(10), 363-364.

LASAGNA, L. and MCCANN, W.P. Effect of "tranquilizing drugs" on amphetamine toxicity in aggregated mice. *Science*, 1957, **125**, 1241-1242 (includes reserpine).

LASCH, F. and THEINL, K. Clinical and experimental studies on the effects of reserpine on the heart and blood circulation and results of blood circulation and results of this therapy in cardiovascular disorders (in German). *Wien. med. Wschr.*, 27 Apr. 1957, **107**(17), 339-343.

LAUBENTHAL, F. Value and dangers of some new drugs with central actions. Meprobamate, phenothiazine compounds, reserpine (in German). *Dtsch. med. Wschr.*, 1957, **82**, 1749-1755.

LAURENCE, W.L. Herb extract as cardiac medication; *Rauwolfia*, an old plant of India, is very often used in coronary disease (in Spanish). *Prensa med. argent.*, 4 May 1956, **43**(18), 1482-1483.

LAUTERBOCK, J. J. and NAGY, J. Hospital experience with *Rauwolfia* alkaloid, reserpine (in German). *Wien. Klin. Wschr.*, 28 Oct. 1955, **67**(43), 839-43.

LAZARTE, J. A. et. al. Huntington's chorea; results of treatment with reserpine. *Proc. Mayo Clinic*, 10 Aug. 1955, **30**(16), 358-65.

LECONTE, M. and BARBIER, A. Combined chlorpromazine-reserpine therapy of a severe heliephrenic-catatonic syndrome of 10 years' duration (in French). *Ann. med. Psychol.*, Nov. 1956, **114**, 637-645.

LE GUILLANT, L. et al. Certain methodological consideration on action of neuroleptics (in French). *Encephale*, 1956, **45**(4), 1128-1135 (includes reserpine).

LEHMANN, A. et al. Audiogenic crisis in mice: modification under the influence of reserpine and methylparafynol carbamate (in French). *J. Physiol.* (Paris), Jan-Mar. 1957, **49**(1), 265-268.

LEHMANN, A. et al. Studies on audiogenic crisis in mice; antagonism between 3-methyl-1-pentyne-3-ol and reserpine (in French). *C.R. Acad. Sci.* (Paris), 1957, **151**(6), 1094-1096.

LEHMANN, E. *Rauwolfia* and the blood-pressure (in German). *Orion*, Sept. 1954, **9**, 689-90.

LEHMANN, E. et al. The use of reserpine in antistic children, *J. nerv. ment. Dis.*, July-Sept. 1957, **125**(3), 351-356.

LEIBERMANN, D.M. and VAUGHAN, G.F. The use of some new pharmacological agents in psychiatry. *J. ment. Sci.*, Jan. 1957, **103**(430), 110-118 (includes reserpine).

LEMERE, F. Combined chlorpromazine-resperpine therapy of psychiatric disorders. *Arch. Neurol. Psychiat.* (Chicago), July 1955, **74**(1), 1-2.

LEMIEUX, G. et al. Treatment of arterial hypertension with rescinnamine, a new alkaloid isolated from *R. serpentina*. *J. Canad. med. Ass.*, 15 Jan. 1956, **74**(2), 144-5.

LEREBOULLET, J. and BENOIT, P. Treatment of delirium tremens with reserpine (in French). *Rev. prat.* (Paris), 21 May 1957, **7**(15), 1667-1670.

LEREBOULLET, J. et al. Painful phantom limb with a depressive syndrome, spectacular cure with reserpine (in French). *Rev. neurol.*, 1955, **92**(5), 386-7.

LEREBOULLET, J. et al. Treatment of delirium tremens with reserpine; experience in 100 cases (in French). *Bull. Soc. med. Hop.* (Paris), 31 May - 7 June 1957, **73**(18-19), 529-537.

LESSIN, A. W. and PARKES, M. W. Hypothermic and sedative action of reserpine in the mouse. *J. Pharm.* (Lond.), 1957, **9**, 657-662.

LEUTIGER, H. A potentiating effect in the treatment of arterial hypertension with *Rauwolfia* (in German). *Dtsch. med. Wschr.*, 24 Aug. 1956, **81**(34), 1361-1363.

LEUTSCHAFT, R. Treatment of autonomic dysregulation with reserpine (in German). *Med. Klin.*, 11 Nov. 1955, **50**(45), 1906-9.

LEVAN, P. and WRIGHT, E.T. Use of tranquilizers in diseases of the skin; a preliminary report. *Calif. Med.*, Aug. 1956, **85**(2), 87-8.

LEVI, P.G. Variations induced by reserpine (Serpasil) therapy on Rorschach's psychogram in mental disorder (in Italian). *Sist. nerv.*, Sept-Oct. 1956, **8**(5), 308-325.

LEVI, P. G. and TOMASETTI, A.L. Results of ondasol therapy (reserpine and α-phenyl-α ethyl-glutamic acid imide) in psychiatry. (in Italian). *Gazz. med. ital.* (Torino), Mar. 1958, **117**(3), 95-101.

LEVI RUFFINELLI, C.A. et al. Modern hypotensors in daily clinical practice concerning 50 cases (in Spanish). *Prensa med. argent.* (B. Aires), 11 Feb. 1955, **42**(6), 384-90.

LEVIATAN, R. *Rauwolfia* and its use in therapy (in Hebrew). *Harefuah*, 15 Mar. 1957, **52**(6), 144-147.

LEVIT, V.G. Supportive and ambulatory treatment with neuroleptic drugs; a review of foreign literature published during 1955-57 (in Russian). *Zh. nevropat. Psikhiat., Moskva*, 1957, **57**(9) 1178-1183 (includes reserpine).

LEVY, B. and KOELLE, G.B. The cardiovascular and respiratory actions of rauwolscine. *J. Pharmacol.*, Aug. 1958, **123**(4), 278-286.

LEVY, C. Drug therapy in management of hypertension. *Delaware State med. J.*, 1954, **26**, 63.

LEWIS, B.I. et al. Central nervous system and cardiovascular effects of *R. serpentina*. *J. Amer. med. Ass.*, 25 Feb. 1956, **160**(8), 622-8.

LEWIS, B.I. et al. *Rauwolfia serpentina* in angina pectoris. *Circulation*, 1956, **14**, 227-232.

LEWIS, D. Reserpine treatment of hypertension, a general practice series. *Med. World*(London), July 1957, **87**(1), 25-30.

LEWIS, L.F. The use of chlorpromazine and of serpasil in the treatment of psychotic patient. *Caribbean med. J.*, 1956, **18**(1-2), 51-66.

LEWIS, ROGER. A. and KOHLI, J.D. Intraduodenal administration of indigenous drugs. *J. sci. industr. Res.*, Oct. 1958, **17C**(10), 168-72. (including experimental study with reserpine and crude alcoholic extract of *R. serpentina*).

LEYDEN, A.F. et al. Pharmaceutical aspects of reserpine. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1956, **45**(12), 771-5.

LIBERSON, W.T. The new tranquilizing drugs. I. Neuropsychiatric aspects. *Amer. J. Nurs.*, 1955, **55**(12), 1465-7.

LIBRO, E. Antagonism between nicotinic acid isopropyl hydrazide and reserpine studied by conditioned reflex in the rat (in Italian). *Boll. Soc. ital. Biol. sper.*, June 1957, **33**(6), 890-891.

LIEBALDT, G. Case of death from reserpine (in German). *Nervenarzt*, 20 Mar. 1958, **29**(3), 110-16.

LIEBECE-HUTTER, S. and BACQ, Z. M. Disappearance of 5-hydroxytryptamine from the granulations of the skin glands of discoglossus pictus and Rana temporaria after injection of reserpine (in French). *Experientia*, May 1958, **14**(5), 180-181.

LIEBOWITZ, D. and CARBONE, J.V. Effect of varying doses of reserpine on gastric secretion. *New Engl. J. Med.*, 1 Aug. 1957, **257**(5), 227-228.

LIEDER, W. Treatment of arterial hypertension with *R. serpentina*, Benth. (in German). *Med. Mschr.* (Stuttgart), 1955, **9**(7), 450-1.

LIESER, H. The possibilities of therapeutically influencing chronically excited insane with phenothiazine and *Rauwolfia* (in German). *Med. Klin.*, 10 Jan. 1958, **53**(2), 65-66.

LIN, CHI-CH'IAG and CH'EN, WEI-CHOU. Studies on drugs for treatment of hypertension. 3. Some pharmacological studies on *Rauwolfia*. *A*. an alkaloid from *Rauwolfia verticillata*(Loui) Baill. *Acta physiol. sin.*, 1957, **21**, 283.

LINDUER, M.A. and HAFKENSCHIEL, J.H. Hexamithonium chloride with reserpine in the treatment of severe essential hypertension. *Angiology*, Feb. 1958, **9**(1), 19-23.

LIPSETT, M.B. et al. *Rauwolfia serpentina;* prolonged use in elderly hypertensive patients. *Calif. Med.*, Nov. 1954, **81**(5), 412-3.

LITZENDORFF, O. Clinical experiences with a new *Rauwolfia* alkaloid combination (in German). *Medizinsche*, 1 June 1957, No. 22, 833-834.

LIVESEY, W.R. et al. *Rauwolfia serpentina* in treatment of hypertension. *J. Amer. med. Ass.*, 1954, **155**, 1027.

LIVESEY, W.R. et al. Treatment of hypertension with *R. serpentina* alone and combined with other drugs: results in 84 cases. *J. Amer. med. Ass.*, 17 July 1954, **155**(12), 1027-35.

LJUNGBERG, E. Reserpine management of chronic schizophrenia and acute anxiety (in Swedish). *Svenska Lakartidn.*, 24 Aug. 1956, **53**(34), 2128-2140.

LJUNGBERG, E. Risks of depression with *Rauwolfia* management (in Swedish). *Svenska Lakartidn.*, 2 Nov. 1956, **53**(44), 2875-2880.

LOCH, W. Megaphen and reserpine therapy of advanced schizophrenia (in German). *Nervenarzt*, 20 Oct. 1956, **27**(10), 463-467.

LOCKET, S. Oral preparations of *R. serpentina* in treatment of essential hypertension. *Brit. med. J.*, 2 Apr. 1955, No. 4917, 809-16.

LOEB, C. et al. Effects of reserpine on the behaviour and electric activity on brain in cats (in Italian). *Boll. Soc. ital. Biol. sper.*, Mar. 1957, **33**(3), 263-264.

LOEB, C. et al. Effects of reserpine on the electric brain activity in cats (in Italian). *Sist. nerv.*, Mar.-Apr. 1957, **9**(2), 49-56.

LOEPER, J. et al. Reserpine in severe hypertension (in French). *Bull. Soc. med. Hop.*(Paris), 22 Feb.-Mar. 1957, **73**(7-8), 195-198.

LOEWE, S. Influence of chlorpromazine, reserpine, desoxycorticosterone upon morphine induced feline mania. *Arch. int. Pharmacodyn.*, 1956, **108**, 453-456.

LOFFLER, W. et al. Therapy of hypertension with serpasil, a *Rauwolfia* alkaloid; clinical

studies (in German). *Schweiz. med. Wschr.*, 17 Oct. 1953, **83**(42) 1012-5.

LORENZ, D. Sedative action of *Rauwolfia* drugs with differing reserpine content compared to reserpine. *Planta Med.*, 15 Dec. 1957, **5**(56), 185-193.

LOTTENBACH, E. Analysis of the mode of action of hypotensive drugs (in German). *Cardiologia*, 1954, **25**(2/3), 66-73.

LOTTENBACH, K. et al. Circulatory actions of a single intravenous dose of serpasil in man (in German). *Schweiz. med. Wschr.*, 9 Feb. 1957, **87**(6), 141-144.

LOVEI, E. and BONA, E. Treatment of hyperthyroidism with *Rauwolfia serpentina* preparation and metothyrin (in German). *Z. ges. inn. Med.*, 15 Apr. 1957, **12**(8), 372-375.

LOWINGER, P. *Rauwolfia serpentina* in the control of anxiety. *Psychiat. Quart.*, July 1957, **31**(3), 445-453.

LUBECK, I. and SCHEFFLER, C. Relation between pulse wave celerity, blood pressure and capillary resistance in labile and fixed hypertension and arteriosclerosis under comparative medication by *Rauwolfia serpentina*, Benth. and a horse chestnut-rutin preparation (in German). *Z. ges. inn. Med.*, 1 June 1957, **12**(11), 510-515.

LUDNAY, G. et al. Reserpine and movement of the intestinal villus (in German). *Arch. int. Pharmacodyn.*, 1958, **114**, 227-231.

LUIZ, H.A. Experience with the use of reserpine on the chronically disturbed mental patient. *S. Afr. med. J.*, 3 Nov. 1956, **30**(44), 1049-1051.

LUSTIG, B. Experiences with sedaraupin in chronic mental disorder (in German). *Med. Klin.* (Berlin), 13 Dec. 1957, **52**(50), 2170-2171.

LUTHY, E. and STUCKI, P. Ambulent therapy of hypertension with serpasil or serpasil-nepresol dosage (in German). *Schweiz. med. Wschr.*, 21 July 1956, **86**(29), 831-834.

LUTTRELL, R.R. and MORRISON, A.V. A preliminary report on the tranquilizing effect of reserpine. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 183-7.

LYAGER, T. and RONTOPP, P.S. Reserpine in therapy of psychoses (in Danish). *Ugeskr. Laeg.*, 12 May 1955, **117**(19), 603-10.

MA, J. and CRANDELL, A. The use of reserpine in the treatment of mental patients who are tuberculous. *Amer. Rev. Tuberc.*, Sept. 1956, **74**(3), 457-461.

MA, J. *Rauwolfia* as a modern hypotensive drug. (in Polish). *Postepy Higieny I Med. Doswiadczalnej* (Warszawa), 1955, **9**(4), 461-507.

MACARTHUR, J.G. The complications of reserpine therapy. *Post. Grad. Med.*, Nov. 1957, **33** (3851), 544-547.

MACCHI, G. et al. Use of reserpine in narcotherapy; early results (in Italian). *Giorn. Psichiat.*, 1954, **82**(4), 1130-4.

MCCOMBS, R.P. Antihypertensive therapy. *Bull. New Engl. med. Centre*, 1953, **15**, 129.

MCCONN, R.G. et al. Administration of the *veratrum* alkaloids protoveratrine and cryptenamine in the treatment of hypertension; the effect of the combination of cryptenamine with chlorpromazine and with *R. serpentina*. *Sth. med. J.*, 1955, **48**(7), 774-81.

MCDONALD, L. and GOLDBERG, B. Renal haemodynamic effects of hypotensive drugs. II. Effects of oral maintenance therapy with pentapyrrolidinium bitartate and reserpine. *Lancet*, 12 Jan. 1957, **272**(6959), 77-78.

MCDONALD, R.K. et al. Effect of aspirin and reserpine on adrenocortical response to piromen in man. *Proc. Soc. exp. Biol.* (N.Y.), 1956, **93**, 343-348.

MCGREGOR, M. and MELIC, R. Reserpine and extracellular fluid volume. *S. Afr. J. med. Sci.*, 1956, **21**, 49.

MCGREGOR, M. and SEGEL, N. The *Rauwolfia* alkaloids in the treatment of hypertension. *Brit. Heart J.*, July 1955, **17**(3), 391-6.

MACIAS CASTRO, I. Therapeutic notes: Use and abuse of *Rauwolfia serpentina* (in Spanish). *Arch. Hosp. Univ.* (Havana), Jan-Feb. 1955, **7**(1), 61-5.

MACLEAN, P.D. et al. Hippocampal function; tentative correlations of conditioning, EEG, drug, and radioautographic studies. *Yale J. Biol. Med.*, Dec. 1955-Feb. 1956, **28**(3-4) 380-95.

MCNAIR, J.D. A new drug in the management of obesity; a preliminary report. *Amer. Practit. Dig. Treatment*, 1955, **6**(11), 1652-3. (*R. serp* with amphetamine for obesity).

MCPHEETERS, H. and FOX, W.W. Evaluation of reserpine and methyl phenidyl acetate used separately and in combination in chronic psychotic patients. *J. Kentuckym ed. Ass.*, Sept. 1956, No. 9, 785-791.

MCQUEEN, E. G. and BLACKMAN, J.D. Direct effects of reserpine, rescinnamine and canescine on blood vessels. *Australian Ann. Med.* (Sydney), Nov. 1955, **4**(4), 250-4.

MCQUEEN, E.G. et al. Circulatory effects of reserpine. *Circulation*, 1955, **11**(2), 161-9.

McQUEEN, E. G. et al. Mechanism of hypotensive action of reserpine, an alkaloid of *Rauwolfia serpentina*. *Nature*, 27 Nov. 1954, **174**, 1015.

MAFFEZZONI, G. and GIAMATTEI, L. Reserpine in the treatment of mental disorders (in Italian). *Osped. Psichiat.*, Apr.-June, 1956, **24**(2), 157-164.

MAGGI, A.L. et al. Action of reserpine on the gastric secretion (in Spanish). *Prensa med. argent.*, 15 Mar. 1957, **44**(11), 770-777.

MAGGIPINTO, B. Indications and advantages of the use of rautirine in obstetrics and gynaecology (in Italian). *Minerva Ginec.* (Torino), 15 Nov. 1955, **7**(21), 787-8.

MAHFOUZ, M. and EZZ, E.A. Effect of reserpine and chlorpromazine on the response of the rat to acute stress. *J. Pharmacol.*, 1958, **123**, 39-42.

MALAMUD, W. et al. The evaluation of the effects of derivatives of *Rauwolfia* in the treatment of schizophrenia. *Amer. J. Psychiat.*, Sept. 1957, **114**(3), 193-200.

MALDONADO, GIL. Contribution to the etiological study of "barrachera" (*Rauwolfia canescens*) (in Spanish). *Rev. Med. vet. Caracas*, July-Dec. 1951, **10**, 137-175.

MALHOTRA, C.L. and SIDHU, R.K. Anti-emetic activity of alkaloids of *R. serpentina*. *J. Pharmacol.*, 1956, **116**(1), 123-9.

MANZINI, E. and FANTIN, V. Effects of reserpine and chlorpromazine on gastric secretion in man (in Italian). *Progr. med.* (Napoli), 30 June 1957, **13**(12), 374-377.

MANZINI, E. et al. A *Rauwolfia serpentina* alkaloid in therapy of arterial hypertension (in Italian). *Minerva med.* (Torino), 8 Dec. 1954, **45**(98), 1525-9.

MARIANI, E. and D'ATTILI, M.L. Brain phosphatases in guinea pig treated with serpasil (in Italian). *Riv. Neurol.*, Sept.-Oct. 1956, **26**(5), 564-568.

MARIANI, E. and D'ATTILI, M.L. Effect of reserpine on cholinesterase activity of the brain in guinea pigs (in Italian). *Boll. Soc. ital. Biol. sper.*, June 1957, **33**(6), 943-94.

MARIANI, E. et al. Variations of cholinesterase activity of the trunk and hemispheres induced by reserpine and chlorpromazine (in Italian). *Boll. Soc. ital. Biol. sper.*, 30 Apr. 1958, **34**(8), 362-364.

MARKOVITZ, M. et al. Hexamethonium, hydralazine and *Rauwolfia serpentina* therapy in hypertension. *Amer. J. med. Sci.*, May 1955, **229**(5), 486-95.

MARKS, B.H. et al. Effect of reserpine and chlorpromazine upon enterochromaffin cell of the rat. *Proc. Soc. exp. Biol.* (N.Y.), Feb. 1958, **97**(2), 413-415.

MARTELLI, A. Reserpine in therapy of arterial hypertension; review of literature and personal contribution (in Italian). *Minerva med.* (Torino), 27 Oct. 1955, **46**(86), 1149-56.

MARTELLI, A. Use of *R. serpentina* in therapy of arterial hypertension (in Italian). *Gaz. med. ital.* (Torino), 2 May 1954, **113**(5), 127-36.

MARTELLI, G. The effects of reserpine therapy on the EEG of mental patients (in Italian). *G. Psichiat. Neuropat.*, 1956, **84**(2), 323-335.

MARTORELL, A. Combined reserpine-phthalazine in arterial hypertension; results (in Spanish). *Angiologia*, May-June 1957, **9**(3), 143-169.

MASCIOCCO, D. Therapy of hypertension; clinical therapeutic experiences with pure alkaloid of *R. serpentina*, serpasil (in Italian). *Arch. E. Maragliano.*, Feb. 1955, **10**(1), 393-408.

MASEK, O. Drug therapy of arterial hypertension. III. (in Czech.). *Vnitrn Lekarstvi* (Brno) 1955, **1**(2), 141-5.

MASIGNANI, V. Comparative study of the effect of chlorpromazine, reserpine and henactysine hydrochloride in anxiety states (in Italian). *Rass. Studi. psichiat.*, 1956, **45**(5), 1114-1115.

MASINI, V. and BRUGNOLI, C. Effects of reserpine on arterial hypertension (in Italian). *Cuore & Circol.*, Apr. 1958, **42**(2), 87-100.

MASON, J.W. and BRADY, J.V. Plasma 17-hydroxycorticosteroid changes related to reserpine effects on emotional behaviour. *Science*, 1956, **124**, 983-984.

MATHISEN, H.S. Rescinnamine treatment for arterial hypertension (in Norwegian). *Tidsskr. norske Laegefore.*, 1 Dec. 1955, **75**(23), 822.

MATHLIE-GUINLET, G. The place of reserpine in the treatment of "Miteval" heart disease (in French). *Sem. med. prof.* (Paris), 30 Dec. 1957, **33**(46), 1776-1779.

MATHUR, B.P. *Rauwolfia* in the treatment of chorea. *Indian J. med. Sci.*, 1958, **12**, 750-753.

MATTOLI, G. and ATLANTE, G. Clinical contributions on reserpine therapy, alone or associated with nepresol (in Italian). *G. Clin. med.*, May 1956, **37**(5), 698-707.

MATTU, FLAVIA and ALQUATI, MARIO. *Rauwolfia* alkaloids. Behaviour with hydroxylamine and with N-chloro-*p*-toluenesulfonamide. *Boll. Chim-farm.*, 1957, **96**, 99-105.

MAUCH, H.P. et al. Mecamylamine-resperine; results of treatment in severe hypertension. *Virginia med. (Semi-) Mon.*, Apr. 1958, **85**(4), 183-186.

MAUREL, H. et al. Psychiatric indications of reserpine (in French). *Encephale*, 1956, **45**(4), 1049-1055.

MAXWELL, R.A. et al. Cardiovascular response of the anaesthetised hamster to reserpine and ganglionic blockade. *Circulation Res.*, 1957, **5**, 414-418.

MAXWELL, R.A. et al. Effects of reserpine on bladder tension. *Proc. Soc. exp. Biol.* (N.Y.), May 1956, **92**(1), 227-30.

MAXWELL, R.A. et al. Influence of adrenergic blockade and an amine oxidase inhibitor on reserpine hypotension. *Proc. Soc. exp. Biol.* (N.Y.), 1957, **95**, 539-41.

MAXWELL, R.A. A peripheral action of reserpine. *J. Pharmacol.*, 1957, **119**, 69-77.

MAY, E. and HEYBLON, R. Extracts of *R. serpentina* roots in therapy of arterial hypertension (in Italian). *Sem. Hop.* (Paris), 2 May 1955, **31**(27), 1531-41.

MAY, E. and HEYBLON, R. Treatment of arterial hypertension with *R. serpentina* (in French). *Bull. Soc. med. Hosp.* (Paris), 13-20 Nov. 1953, **69**(28-29), 958-66.

MAY, R.H. and VOEGELE, G.E. Parkinsonian reactions following chlorpromazine and reserpine. Similar reactions in the same patients. *Arch. Neurol. Psychiat.* (Chicago), May 1956, **75**, 522-524.

MAYER, G. et al. Harmonal state induced in the female rat by reserpine administration. Effect of oestrogen. *C.R. Acad. Sci.* (Paris), 1958, **247**, 524

MAYER, S.W. et al. Direct antithyroid action of reserpine, chlorpromazine and other drugs. *J. Pharmacol.*, 1956, **117**, 197-201.

MAZUMDAR, D.C. and MUKERJEE, K.L. *Rauwolfia serpentina* in hypertension *J. Indian med. Ass.*, 1950, **19**, 362-67.

MAZZA, A. and PEDRELLI, M. Reserpine therapy in schizophrenia (in Italian). *Riv. sper Freniat.*, 1 Oct. 1956, **80**(4), 877-886.

MEATH, J.A. et al. Comparison of reserpine and placebo in treatment of psychiatric outpatients. *Arch. Neurol. Psychiat.* (Chicago), Aug. 1956, **76**(2), 207-214.

MECIANI, L. Hypotensive treatment with a combination of reserpine and chlorisondamine (in Italian). *Clinica ter.* (Roma), May 1958, **14**(5), 502-526.

MEHTA, N.R. Use of *Rauwolfia serpentina* in medical practice. *Med. Dig.* (Bombay), 1958, **26**, 273-276.

MEIER, R. et al. Effect of reserpine, a new alkaloid from *R. serpentina*, Benth. on the central nervous system in animals (in French). *C.R. Acad. Sci.*(Paris), 22 Feb. 1954, **238**(8), 961-3.

MEIER, R. et al. Hypotensive effect of reserpine, a new *R. serpentina*, Benth. alkaloid, on animals (in French). *C.R. Acad. Sci.* (Paris), 25 Jan. 1954, **238**(4), 527-8.

MEIER, R. et al. Pharmacodynamic differentiation of apresoline (A), serpasil (S), and chlorpromazine (Ch) by their water-retaining action (in French). *Arch. int. Pharmacodyn.*, 1955, **104**, 137-145.

MEITES, J. Effect of reserpine in prolactin content of rabbit pituitary. *Proc. Soc. exp. Biol.*, (N.Y.), 1958, **97**(4), 742-744.

MEITES, J. Induction of lactation in rabbits with reserpine. *Proc. Soc. exp. Biol.* (N.Y.), 1957, **96**, 728-730.

MELCHING, H.J. and LANGENDORF, M. The *Rauwolfia* alkaloid, reserpine as an effective protection against radiation. *Naturwissenschaften*, 1957, **44**, 377.

MELICK, R. and MCGREGOR, M. Reserpine and extra cellular fluid volume. *New Engl. J. Med.*, 23 May 1957, **256**(21), 1000-1002.

MELLER, R. L. Reserpine alseroxylon therapy in emotionally disturbed patients. *J. Lancet*, Aug. 1955, **75**(8), 339-42.

MENESES HOYOS, J. New hypotensive drugs; *R. serpentina* (in Spanish). *Medicina; Revista Mexicana* (Mexico), 25 Sept. 1955, **35**(732), 425-8.

MENGER, P. Serpasil and multiple sclerosis (in French). *Ann. med. Psychol.*, Dec. 1956, **2**(5), 887-890.

MENGHI, G. et al. Notes on the function and morphology of the liver in patients treated with large doses of reserpine (in Italian). *Minerva med.* (Torino), 6 June 1958, **49**(45), 2241-2243.

MENON, K.P.G. and RAMAKRISHNAN, V.N. Clinical trials with reserpine in diabetes melitus. *Antiseptic*, 1957, **54**, 91-96.

MERCIER-PAROT, I. and TUCHMANN-DUPLESSIS, H. Influence of reserpine on the oestrous cycle of the rat (in French). *C.R. Acad. Sci.* (Paris), 9 May 1955, **240**(19), 1935-6.

MERIEL, P. et al. Efficiency of reserpine in the treatment of hyperthyroidism (in French). *Bull. Acad. nat. Med.* (Paris), 29 Apr.- 6 May 1958, **142**(15-16), 458-461.

MEURICE, E. Treatment of 50 chronic schizophrenics with high doses of reserpine (in French). *Acta neur. belg.*, Dec. 1956, **56**(12), 827-841.

MEUSERT,W. The ambulant use of reserpine in neurological practice (in German). *Praxis*, 1958, **47**(42), 991.

MEYER, A. Effects of *Rauwolfia* extracts (in German). *Ther. Umsch.*, Jan. 1955, **11**(10), 183-4.

MEYER, GERHAD. *Rauwolfia serpentina*, a new drug for treatment of high (blood) pressure (in German). *Deut. Apoth. Ztg. Ver. Suddent. Apoth. Ztg.*, 1952, **92**, 435-6.

MEYER, H.H. Phenothiazine and reserpine therapy of schizophrenia (in German). *Med. Klin.*, 27 Dec. 1957, **52**(52), 2253-2254.

MEYER, H.H. Phenothiazine and reserpine treatment of psychoses (in German). *Psychiat. Neurol. med. psychol. Lpz.*, Mar. 1957, **9**(3), 78-83.

MEYER-LEDDIN, H. Therapy of hypertension with a pure alkaloid of *R. serpentina* (in German). *Med. Klin.*, 19 Feb. 1954, **49**(8), 295-8.

MEZEY, K. *Rauwolfia hirsuta* as an anti-hypertensive agent in man. *J. Pharmacol.*, Jan. 1957, **119**(2), 168 (abstract).

MIEDZIANOWSKI, A. *Rauwolfia serpentina* in internal diseases (in Polish). *Pol. med. Wkly.*, 24 June 1957, **12**(26), 1010-1055.

MIELKE, F.A. Anamnesis and catamnesis of schizophrenic treated with reserpine; with a study of the drug test method of psychiatry (in German). *Nervenartz*, 20 Mar. 1957, **28**(3), 111-119.

MIELKE, F.A. Methods employed and results obtained in psychiatric studies with new drugs acting on the brain stem. *Amer. J. Psychiat.*, Aug. 1957, **114**(2), 134-139 (includes reserpine).

MIELKE, F.A. Review of the clinical experience with serpasil in the Burgholzl Hospital (in German). *Schweiz. med. Wschr.*, 7 May 1955, **85**(19), 440-2.

MIGLIAVACCA, A. and FERRARIS, F. Sedative action of reserpine in preoperative anxiety in gynaecology (in Italian). *Minerva gin.* (Torino), 30 June 1956, **8**(12), 528-630.

MIKSZTAL, M.W. Chlorpromazine (thorazine) and reserpine in residential treatment of neuropsychiatric disorders in children. *J. nerv. ment. Dis.*, May 1956, **123**(5), 477-479.

MILLER, NINA CARTER. Reserpine (Serpasil), an alkaloid of *Rauwolfia serpentina* in the treatment of hypertension (in French). Thesis Med., Univ. Geneve, 1956, 49pp.

MILLI, N. and MARZI, F. Serpasil in mental diseases (in Italian). *Riv. pat. ment. nerv.*, 1956, **77**(2), 502-505.

MILOSEVIC, M.P. Effect of reserpine and 5-hydroxytryptamine (Serotonin) in adrenaline toxicity (in Serbo-Croatian). *Acta med. ingosl.*, 1957, **11**(1-2), 184-185.

MINATOYA, A. Hypotensive activity of the combination of a new oral adrenolytic drug and reserpine in renal hypertensive rats. *Fed. Proc.*, Mar. 1956, **15**, 460 (abstract).

MINER, R.W. (*Ed.*) Reserpine in the treatment of neuropsychiatric, neurological and related clinical problems. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**, 1-280. (Proc. of the Conference on reserpine in the treatment of mental illnesses. The vol. gives nearly 30 papers by reputed workers during the Second Conference held in Feb. 1955). Abstract in *Amer. J. Pharm.*, **127**(6), 1955, 215.

MINZ, B. Action of tranquillising drugs on the reaction of the cerebral cortex to adrenaline (in French). *C.R. Soc. Biol.* (Paris), 1957, **151**, 432-436 (includes reserpine).

MINZ, B. Effects of tranquilizing drugs on cerebral cortical reactions to epinephrine. *Fed. Proc.*, Mar. 1957, **16**, 323 (abstract).

MIRKIN, BERNARD L. Catechol amine depletion in the rat's denervated adrenal gland following chronic administration of reserpine. (Lett.). *Nature*, 12 July 1958, **182**(4628), 113-14.

MITRA, P. et al. Bengal variety of *Rauwolfia serpentina* in hypertension. *Bull. Calcutta Sch. trop. Med.*, 1955, **3**, 177.

MIVELAZ, M. Sleep therapy by means of serpasil-doriden combination (in French). *Praxis*, 11 Apr. 1957, 334-338.

Modern Encyclopaedia and Therapeutic Index, 6th ed. New Haven (Connecticut), Drugs Publications, 1955. (Proprietary names of *Rauwolfia* preparations, pp. 888-891; 937-938).

Modern management of hypertension. *Indian J. Pharm.*, 1955, **17**(8), 162-165.

MOEHLIG, R.C. The anxiety state, its similarity with that produced by *Rauwolfia* drugs. *Med. Times* (Great Neck), May 1957, **85**(5), 495-497.

MOERSMESSMER, R. The preparation of rausupol (in German). *Fortschr. Med.*, 1955, **73**, 22.

MOLINA, A. *Rauwolfia serpentina* with special reference to reserpine (in Spanish). *Rev. med. cubana*, July 1956, **67**(7), 623-627.

MONCKE, C.L. Influence of reserpine on metabolism in hyperthyroidism (in German). *Med. Wschr.* (Stuttgart), Jan. 1957, **11**(1), 18-19.

MONCKE, C.L. Management of hyperthyroidism with reserpine (in German). *Medizinische*, 15 Oct. 1955, No. 42, 1742-4.

MONROE, R. R. et al. Comparison of cortical and sub-cortical brain waves in normal, barbiturate, reserpine, and chlorpromazine sleep. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 56-71.

MONTAGNARI, F. and GERMANO, V. Pre-eclamptic state with episode of confusion and onirism remitting after intravenous reserpine (in Italian). *Riv. sper. Freniat.*, 1 Oct. 1956, **80**(4), 977-979.

MOORE, J.G. et al. Hemodynamic effects of *Rauwolfia* alkaloids (reserpine) in human pregnancy, results in intravenous administration. *Amer. J. Obstet. Gynec.*, 1956, **71**(2), 237-46.

MOORE, J.N. and MARTIN, E.A. Trial of reserpine in treatment of schizophrenia. *Brit. med. J.*, 5 Jan. 1957, No. 5009, 8-14.

MOORE, R.B. et al. The story of reserpine. *J. Indiana St. med. Ass.*, 1954, **47**(8), 835-61.

MORGAN, D.R. Chlorpromazine and reserpine in the treatment of chronic mental illness. *Med. J. Aust.*, 14 July 1956, **43**, 57-62.

MORGAN, D.R. The combined use of chlorpromazine and reserpine in the treatment of chronic mental illness: a preliminary report. *Med. J. Aust.*, 16 July 1955, **42**(3), 77-80.

MORITZ, E. Clinical experiences with raupental in the long term treatment of essential hypertension (in German). *Wien. med. Wschr.*, 22 Feb. 1958, **108**(8), 179-180.

MORTON, H. G. and WARSON, S. R. Control study on reserpine in small groups of children with neurologic disorders. *J. Fla. med. Ass.*, Feb. 1957, **43**(8), 786.

MOSER, M. et al. Drug therapy in hypertension. II. Experience with reserpine, apresoline, ansolysen, ecolid and mecamylamine (inversine). *N.Y. St. J. Med.*, Aug. 1956, **56**(16), 2487-97.

MOYER, J.H. Cardiovascular and renal hemodynamic response to reserpine (Serpasil) and clinical results of using this agent for the treatment of hypertension. *Ann. N.Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 82-94.

MOYER, J.H. Clinical use of reserpine (Serpasil) in geriatrics. *Ann. N.Y. Acad. Sci.*, 1954, **59**(1), 95.

MOYER, J.H. and DENNIS, E.W. Treatment of hypentension. III. Pharmacodynamics in therapy: peripherally acting agents. *Sth. med. J.* (Birmingham), 1956, **49**(1), 76-85.

MOYER, J.H. and LIVERSAY, W.R. Treatment of hypertension with *R. serpentina* alone and in combination with hexamethonium or hydralazine. *Amer. J. Med.*, 1954, **16**, 605.

MOYER, J. H. et al. The cardiovascular and renal hemodynamic response to the administration of reserpine (Serpasil). *Amer. J. med. Sci.*, 1954, **227**(6), 640-8.

MOYER, J. H. et al. Clinical results with the use of roxinil (an extract of *R. serpentina*) in the treatment of hypertension. *Amer. Heart J.*, 1955, **49**(5), 751-7.

MOYER, J.H. et al. Comparison of results in the treatment of hypertension with *R. serpentina* alone and in combination with hexamethonium or hydralazine. *J. Lab. clin. Med.*, 1953, **42**, 926.

MOYER, J. H. et al. Deserpidine (Canestine) for the treatment of hypertension. *Sth. med. J.* (Nashville), 1957, **50**, 499-502.

MOYER, J.H. et al. Observations of cardiovascular and renal hemodynamic responses to reserpine and clinical results in treatment of hypertension. *Clin. Res. Proc.*, 1954, **2**, 72.

MOYER, J. et al. Mecamylamine (inversive) in the treatment of hypertension. *J. Amer. med. Ass.*, 24 Aug. 1957, **164**(14), 1879-1886 (includes reserpine).

MOYER, J.H. et al. Results with a combination of *Rauwolfia* and adrenergic blockade in the treatment of hypertension. *Amer. J. med. Sci.*, July 1955, **230**(1), 33-44.

MUKERJI, B. Concluding remarks on *Rauwolfia* in modern therapy. *Indian J. Pharm.*, 1956, **18** (11), 433-40.

MUKHERJEE, J.N. Effect of rauwolscine on the action of adrenaline on blood pressure. *Nature*, 7 Nov. 1953, **172**, 867.

MUKHERJEE, J.N. Studies on the pharmacology of rauwolscine, the alkaloid of *R. canescens*, Linn. *Sci. & Cult.*, 1953, **7**, 338.

MUKHERJEE, J.N. and SEN, P.B. Action of rauwolscine hydrochloride, the alkaloid of *R. canescens*, on amphibian and mammalian heart muscle. *Indian J. Physiol. Allied Sci.*, 1953, **7**, 57-67.

MUKHERJEE, J.N. and SEN, P.B. Comparative studies of the alkaloids of *R. serpentina*, Benth. and *R. canescens*, Linn. on the blood pressure of cat. *Proc. Indian Sci. Congr.*, 1954, **41**(3), *Abst. Sec. Physiol.*, pp. 276-77.

MUKHERJEE, J.N. and SEN, P.B. Determination of toxicity and therapeutic dose of rauwolscine. *Proc. Indian Sci. Congr.*, 1955, **42**(3), *Abst. Sec. Physiol.*, 394.

MUKHERJEE, J.N. and Sen, P.B. Effect of rauwolscine hydrochloride on the blood pressure of normal cat. *Indian J. Physiol. Allied Sci.*, 1953, **7**, 109-17.

MUKHERJEE, J.N. and SEN, P.B. Effect of rauwolscine hydrochloride on the plain muscles of intestine and uterus of guinea pig. *Indian J. Physiol. Allied Sci.*, 1953, **7**, 148-52.

MUKHERJEE, J.N. and SEN, P.B. Effects of rauwolscine hydrochloride on the voluntary muscle. *Proc. Indian Sci. Congr.*, 1955, **42**(3), 389 (abstract).

MUKHERJEE, J.N. and SEN, P.B. Site of hypotensive action of rauwolscine hydrochloride. *Proc. Indian Sci. Congr.*, 1955, **42**(3), 393-94 (abstract).

MUKHERJEE, K. L. and WERNER, G. Depletion of ascorbic acid from the adrenal glands through rauwolscine. (Lett.). *Sci. & Cult.*, 1954, **20**(3), 144.

MULLER, J.C. et al. Depression and anxiety occurring during *Rauwolfia* therapy. *J. Amer. med. Ass.*, 1955, **159**(9), 836-839.

MUNCH-PETERSEN, S. Effects of chlorpromazine (largactil) and reserpine, serpasil within the field of neurology; a study of pertinent literature. *Acta psychiat.*, Suppl. 108, (Kbh.), 1956, 269-280.

MURPHREE, O.D. and PETERS, J.E. The effects of reserpine on fixation in rats after electroconvulsions and insulin comas. *J. nerv. ment. Dis.*, July 1956, **124**(1), 78-83.

MUSA, F. Indications and contraindications for reserpine in heart diseases (in Italian). *G. Clin. med.*, May 1957, **38**(5), 746-769.

MUSCHOLL, E. and VOGT, M. The action of reserpine on the peripheral sympathetic system. *J. Physiol.*, 3 Apr. 1958, **141**(1), 132-155.

MUSCHOLL, E. and VOGT, M. Concentration of adrenaline in the plasma of rabbits treated with reserpine. *Brit. J. Pharmacol.*, 1957, **12**, 532-535.

MURATTI, J.B. Reserpine; therapeutic use in schizophrenia (in Spanish). *Dia. med.*, 2 May 1957, **29**(26), 750-751.

MURELLI, B. et al. Reserpine, electroshock and serotonin content of the brain (in Italian). *Boll. Soc. ital. Biol. sper.*, June 1957, **33**(6), 857-859.

MUSSER, RUTH and BIRD, JOSEPH D. Modern pharmacology and therapeutics. New York, Macmillan, 1958. (Rauwolfia and its alkaloid, 322-327; 562-566; 575-577).

NADER, M.B. Reserpine in cholinergic treatment and cholinergic insulin therapy in diabetes mellitus (in German). *Wien. Klin. Wschr.*, 14 Mar. 1958, **70**(11), 193-195.

NAEGELE, C.F. et al. Combined *Rauwolfia* hydralazine therapy of hypertensive patients. *Circulation*, 1955, **11**(2), 182-7.

NAESS, K. and SCHANCHE, S. Effect of reserpine on 5-hydroxytryptamine (serotonin) in rabbit serum. *Acta pharm. tox.* (Kbh.), 1956, **12**(4), 408-410.

NAESS, K. and SCHANCHE, S. Effect of reserpine on serotonin in rabbit serum. *Nature*, 16 June 1956, **177**, 1130-31.

NAGENDRANATH, C.K. Two cases of paranoia treated with *R. serpentina*. *Indian J. Neurol. and Psychiat.*, 1950, **2**, 62.

NAIDOO, D. Effect of reserpine (Serpasil) on the chronic disturbed schizophrenic; a comparative study of *Rauwolfia* alkaloids and electro-convulsive therapy. *J. nerv. ment. Dis.*, 1956, **123**(1), 1-13.

NAKAMURA, KAZUYUKI. Pharmacological and clinical reviews on *Rauwolfia* alkaloids. *Shinyake to Rinsho.*, 1955, **4**, 19-32.

NEGOESCU, I. et al. Action of serpasil on the calarigenic effect of thyroxine, and iodine fixation in the rat. *Endocrinologia*, 1957, **2**(1), 40-46.

NEGRI, V.U. and GARAVAGHA, G. Clinical study of unusual effect of reserpine in psychiatry (in Italian). *Minerva med.* (Torino), 3 Nov. 1955, **46**(88), 1217-29.

NELSON, J. W. and SCHLAGEL, C.A. A preliminary note on a pharmacological investigation of the hypotensive action of *R. serpentina*. Benth. *J. Amer. pharm. Ass.* (*Sci. Ed.*), 1953, **42**(5), 324.

NEUER, H. Serpasil in the treatment of acute alcoholic psychoses. *Ohio St. med. J.*, 1955, **51**(8), 749-51.

NEUGEBAUER, R. and LONG, E.K. The effect of *R. serpentina*, Benth. Total extracts on carbohydrate metabolism (in German). *Wien. med. Wschr.*, 12 Dec. 1953, **103**(50), 966-7.

NEUMANN, H. Dosage changes in combined reserpine-phenothiazine treatment (in German). *Nervenartz*, 20 June 1958, **29**(6), 269-270.

NEVEU, P. et al. Clinical study of failures of reserpine therapy in the treatment of chronic psychoses (in French). *Ann. med. psychol.*, Jan. 1958, 98-100.

NEVEU, P. et al. Complications observed during reserpine therapy (in French). *Ann. med. psychol.*, Nov. 1957, 744-749.

New and non-official remedies. *J. Amer. med. Ass.*, 19 Nov. 1955, **159**(12), 1204-9 (incl. ref. to reserpine).

New drugs for patients with emotional disorders. *J. Amer. med. Ass.*, 19 Feb. 1955, **157**(8), 665.

NICK, J. Melancholia in hypertensive patients caused by therapeutic use of *R. serpentina* (in French). *Bull. Soc. med. Hop.* (Paris), 14-21 Oct. 1955, **71**(23-24), 884-93.

NICKELL, L.G. Root that relieves blood pressure. *Nat. Hist.*(N.Y.), Jan. 1956, **65**, 16-19.

NICOLETTI, I. and MAGHERINI, G. Factor analysis in clinocotherapeutic researches. I. Factor analysis, its fundamentals and practical applications, method of central approach. II. Application of factor analysis in a group of schizophrenics after treatment of various types (in Italian). *Rass. Studi. psichiat.*, Nov- Dec. 1957, **46**(6), 903-933 (includes treatment with reserpine).

NIEVEEN, J. The action of reserpine (Serpasil) in essentially benign hypertension (in Dutch). *Ned. tijdschr. Geneesk.*, 10 Nov. 1956, **100**(45), 3251-3255.

NISWANDER, G.D. and HOLT, E.K. Combination reserpine-methylphenidylacetate in epileptics with psychosis. *Dis. nerv. Syst.*, Jan. 1957, **18**(1), 11-15.

NISWANDER, G.D. et al. Reserpine and methylphenidylacetate effects on socialization and activity. *J. nerv. ment. Dis.*, Jan.-Mar. 1957, **125**(1), 51-56.

NOBILE, S. Electroencephalographic changes after prolonged serpasil therapy (in Italian). *Rass. Studi. psichiat.*, 1956, **45**(5), 1028-1029.

NOBILE, S. and COSSIO, M. Remarks on experimental catatonia induced with reserpine (in Italian). *Riv. pat. nert. ment.*, 1957, **78**(3), 1068-1069.

NOCE, R.G. et al. Reserpine (Serpasil) in the management of the mentally ill and mentally retarded; preliminary report. *J. Amer. med. Ass.*, 20 Oct. 1954, **156**(9), 821-4.

NOCE, R.H. et al. Reserpine (Serpasil) in the management of the mentally ill. *J. Amer. med. Ass.*, 1955, **158**(1), 11-15.

NOCETI, D. and NASTA, A.G. Combined serpasil and doriden in the treatment of pain in chronic peripheral arterial diseases and in preoperative and post-operative sedation (in Italian). *Gazz. med. ital.* (Torino), Apr. 1955, **114**(4), 82-5.

NORBURY, F.G. Danger signal for mental illness. *Med. Times* (Manhasset), June 1958, **86**(6), 864-868 (includes reserpine).

NORDMAN, L.O. Reserpine as a therapeutic agent in advanced psychoses (in Swedish). *Nord. Med.*, 1958, **59**(23), 798-802.

NORTON, S. and DE BEER, E.J. Evaluation of drugs affecting the psyche by cat behaviour studies. *Fed. Proc.*, Mar. 1956, **15**, 463-464 (abstract includes reserpine).

NOWAK, S. and BIENIASZ, A. Additional reports on the therapeutic use of adelphan and serpasil in pre-eclamptic states and in eclampsia (in Polish). *Pol. med. Wkly.*, 25 Nov. 1957, 1813-1816.

NUMEROF, P. et al. The metabolism of reserpine. II. Studies in schizophrenic patients. *Psychiat. Res. Rep.* (Washington), Mar. 1958, No. 9, 143-144.

NUMEROF, P. et al. The metabolism of reserpine. I. Studies in the mouse with C-14 labelled reserpine. *J. Pharmacol.*, Dec. 1955, **115**(4), 427-31.

OFSTAD, M. Chlorpromazine and reserpine: data from the Ostmark Hospital (in Norwegian). *Tidsskr. norske Laegeforen*, 15 Oct. 1957, **77**(20), 906-909.

OGIU, KIKUO et al. Site of action of reserpine, chlorpromazine and lysergic acid diethylamide on the central nervous system. *Proc. Japanese pharm. Soc.*, Apr. 1957, 5-6.

OLDS, J. et al. Self-stimulation of the brain used as a screening method for tranquilizing drugs. *Science*, 10 Aug. 1956, **124**, 265-266 (includes reserpine).

OLSEN, A.L. and VANDER-KAMP, H. Evaluation of the use of reserpine in the psychosis. *J. Mich. med. Soc.*, Oct. 1957, **56**(10), 1271-72.

ORGAIN, EDAWRD S. et al. Newer drugs in the treatment of hypertension. *J. Amer. med. Ass.*, 26 Apr. 1958, **166**(17), 2103-2107 (includes reserpine).

OTTAVIANI, P. and BORGHETTI, A. Reserpine in the therapeutic complex of Flajani-Basedow disease (in Italian). *Gi. Clin. med.* (Parma), Oct. 1955, **36**(10), 1337-54.

OVERGAARD, J. Effects of reserpine and 5-hydroxytryptamine, with reference to a case of serpasil poisoning in a two year old child (in Danish). *Ugeskr. Laeg.*, 3 Oct. 1957, **119**(40), 1293-1303.

OVERHOLSER, W. Psychobiologic advances and management of hospitalized patients. *J. clin. exp. Psychopath.*, Oct.-Dec. 1956, **17**(4), 378-380 (includes treatment with reserpine).

PAASONEN, M.K. and DEWS, P.B. Effect of raunescine and isoraunescine on behaviour and on the 5-hydroxytryptamine and noradrenaline contents of brain. *Brit. J. Pharmacol.*, Mar. 1958, **13**(1), 84-88.

PAASONEN, M.K. and KRAYER, O. Effect of reserpine upon the mammalian heart. *Fed. Proc.*, Mar. 1957, **16**, 326-327 (abstract).

PAASONEN, M.K. and KRAYER, O. Release of noradrenaline from the mammalian heart by reserpine. *J. Pharmacol.*, 1958, **123**, 153-160.

PACKMAN, E.W. et al. A preliminary study of the pharmacology of 11-desmethoxyreserpine (raunormine) an alkaloid from *R. canescens*. II. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1956, **45**(2), 89-93.

PAGE, I.J. A clinical evaluation of antihypertensive drugs. *Bull. N.Y. Acad. Med.*, Apr. 1957, **33**(4), 246-262 (includ s reserpine).

PALLISTER, P.D and STEVENS, R.R. Effects of serpasil in small dosage on behaviour, intelligence and psychology. *Amer. J. ment. Defic.*, Sept. 1957, **62**(2), 267-279.

PALMER, R.S. Hypotensive action of ambulatory patients with hypertension. *Amer. Practit. Dig. of Treatment*, Sept. 1955, **6**(9), 1323-7.

PANACCIO V. Action of reserpine in various dermatological diseases (in German). *Un. med. Canad.*, June 1955, **84**(6), 672-4.

PARKHURST, A.S. et al. Role of brain serotonin in reserpine action. *Ann. N.Y. Acad. Sci.*, 1957, **66**, 609-617.

PASSERI, M. *Rauwolfia* and insulin free pancreatic extracts in the treatment of hypertension (in Italian). *G. clin. med.*, June 1957, **38**(6), 925-933.

PASSOUANT, P. et al. Effect of reserpine on cortical and rhinencephaltic rhythms in chronic conditions in cat (in French). *C.R. Soc. Biol.* (Paris), 10 Sept. 1956, **150**(4), 779-782.

PAUKER, J.D. A study of sex hormones and reserpine on psychological functions in the aged. *Dissert. Abst.*, 1957, **17**(10), 2316.

PAUS, W. Treatment of hypertension with several purified *Rauwolfia* alkaloids (in German). *Medizinische*, 29 June 1957, No. 26, 987-989.

PAYN, S.B. Cerebellar involvement during reserpine therapy. *Amer. J. Psychiat.*, July 1956, **113**(1), 75.

PAYN, S.B. Hypothermia following reserpine. *Amer. J. Psychiat.*, Feb. 1956, **112**(8), 657.

PEARL, D. et al. The effects of reserpine on schizophrenic patients. *Arch. Neurol. Psychiat.* (Chicago), Aug. 1956, **76**(2), 198-204.

PELLERITO, N. Action of chlorpromazine and reserpine on the anxiety of psychoneurotics (in Italian). *Minerva med.* (Torino), 12 Sept. 1956, **47**(73), 628-631.

PELNER, L. Bleeding peptic ulcer (after use of *Rauwolfia* preparations). *J. Amer. med. Ass.*, 16 Oct. 1954, **156**, 736.

PENCHEV, I. and TSVINSEROVA, K.H. *Rauwolfia serpentina* alkaloid therapy of hypertension (in Bulgarian). *Sruvem. med.* (Sofia), 1957, **8**(10), 25-31.

PENMAN, A.S. and DREDGE, T.E. Effect of reserpine and openward privileges on chronic schizophrenics. *Arch. Neurol. Psychiat.* (Chicago), July 1956, **76**(1), 42-9.

PENNEFATHER, J.N. and THORP, R.H. The influence of β-tetrahydronaphthylamine and a derivative on the central effects of 5-hydroxytryptamine, reserpine and iproniazid. *J. Pharm.* (London), Apr. 1958, **10**(4), 249-254.

PEPIN, J.M. et al. The treatment of arterial hypertension with recanesciene; a new alkaloid isolated from *Rauwolfia*. *Canad. med. Ass. J.*, 15 Mar. 1957, **76**(6), 486-488.

PERERA, G.A. Edema and congestive failure related to administration of *R. serpentina* *J. Amer. med. Ass.*, 1 Oct. 1955, **159**(5), 439.

PERERA, G.A. *R. serpentina* in hypertensive vascular disease. *Proc. Soc. exp. Biol.* (N.Y.), July 1954, **86**(3), 453-6.

PERRAULT, M. and GAUTIER, J.C. Effect of tranquilizing agents on endocrine glands (in French). *Sem. med. profes.* (Paris), 22 Nov. 1957, **33**(42), 1626-1632. (includes reserpine).

PERRETTA, A. et al. Injectable reserpine and arterial tension (in Spanish). *Sem. med.* (B. Aires), 18 Nov. 1954, **105**(21), 940-2.

PERSSON, I. Combined pentapyrrolidin and reserpine therapy of hypertension (in Danish). *Ugeskr. Laeg.*, 5 May, 1955, **117**(18), 568-71.

PESSAGNO-ESPORA, M.A. Pharmacology and therapeutic use of reserpine and *Rauwolfia serpentina* (in Spanish). *Rev. Pub. Nav.* (B. Aires), Sept.-Dec. 1955, **8**(5-6), 203-221.

PETERS, L. Pharmacology of the useful antihypertensive drugs. *Arch. intern. Med.*, Oct. 1956, **98**(4), 409-415 (includes reserpine).

Pharmacology of reserpine. *Lancet*, 12 Mar. 1955, **268**, 548-9.

Phytotherapy in arterial hypertension (in Italian). *Athena* (Rome), 1954, **20**(2), 85-6 (incl. serpentina therapy).

PICCINELLI, O. Pharmacology and clinical aspects of *R. serpentina* (in Italian). *Farmaco: Edizione Pratica* (Pavia), Nov. 1954, **9**(11), 574-82.

PICKERING, G.W. High blood pressure. London, Churchill, 1955. (*R. serp.*, pp. 333-35.)

PIERE, J. and WAHL, M. New observations on the treatment of arterial hypertension by the total alkaloids of *Rauwolfia serpentina* or *sarpagandah* (in French). *Concours Med.*, 1 Dec. 1956, **78** (48), 5061-68.

PIERI, J. and WAHL. M. Treatment of arterial hypertension with total alkaloids of *R. serpentina* or *sarpagandah* (in French). *Concours Med.*, 19 Nov. 1955, **77**(47), 4321-32.

PIERI, J. et al. Results from the study of a new sympatholytic alkaloid, raubasine, in therapy of arteritis (in French). *Pr. med.*, 2 Oct. 1957, **65**(70), 1569-71.

PILLEN, D. Combination therapy of hypertension (in German). *Arzneimittel Forsching*, 10 Dec. 1957, **11**(12), 607-612 (includes reserpine).

PINES, I. So-called activity of balance of several cardiovascular medicinal agents (in French). *Lyon med.*, 22 Dec. 1957, **89**(51), 681-695 (includes reserpine).

PIOMELLI, S. et al. Effects of reserpine on blood coagulation and fibrinolysis (in Italian). *Progr. med.* (Napoli), 15 Dec. 1957, **13**(23), 769-772.

Placebos versus reserpine. *Science*, 27 July 1956, **124**, 168.

PLATSCHER, A. et al. Serotonin as a mediator of reserpine action in brain. *J. Pharmacol.*, 1956, **116**(1), 84-9.

PLATSCHER, A. et al. Serotonin release as a possible mechanism of reserpine action. *Science*, 26 Aug. 1955, **122**, 374-5.

PLATT, R. and SEARS, H. T. N. Reserpine in severe hypertension. *Lancet*, 14 Apr. 1956, 401-403.

PLICZER, M. et al. Application of *R. serpentina* in autonomic functional regulation disorders (in Hungarian). *Orvosi. Hetil.*, 15 May 1955, **96**(20) 548-9.

PLUMMER, A.H. et al. The influence of ritalin (methylphenitade) on the behavioral and circulatory effects of reserpine. *Schweiz. med. Wschr.*, 7 Apr. 1957, **87**(14), Suppl., 370-374.

PLUMMER, A.J. *Rauwolfia* tranquilizing action explained. *Oil Paint Drug Reptr.*, 25 June 1956, **169**, 7.

PLUMMER, A.J. et al. The action of reserpine on the motility of the digestive tract. *Amer. J. digest. Dis.*, Dec. 1955, **22**(12), 337-42.

PLUMMER, A.J. et al. Influence of methyl-α-phenyl-2- piperidine acetate hydrochloride on the pharmacological actions of reserpine. *Fed. Proc.*, Mar. 1956, **15**, 468 (abstract).

PLUMMER, A.J. et al. Pharmacology of *Rauwolfia* alkaloids including reserpine. *Ann. N.Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 8-21.

PLUMMER, A.J. et al. Sedative and hypnotic action of reserpine in unanesthetized animals. *Fed. Proc.*, 1953, **12**, 357.

POKORNY, C. et al. An effect of *Rauwolfia* alkaloids on the thyroid. *Growth*, 1957, **21**(2), 89-93.

POLAK, F. Antiallergic effect of *Rauwolfia* alkaloid: reserpine (in German). *Schweiz. med. Wshcr.*, 30 July 1955, **85**(31), 751-752.

POLAK, F. and MENICK, Z. Behaviour of the circulation of hypertension patients on receiving separate and combined reserpine and bi-hydrazinophthalazin treatment in short-term experiments (in German). *Dtsch. Gesundheitswes.*, 1958, **13**(23), 843.

POLAK, F. and MENCIK, Z. Effects of digestive activities on blood pressure regulation in hypertension under the effects of reserpine and phythalazine bodies (in German). *Z. Kreisl-Forsch.*, Feb. 1958, **47**(3-4), 97-106.

POLLACK, B. Mental illness. *Med. Times* (Great Neck), 1955, **83**(5), 439-50. (Reserpine in mental disorders).

PORTELLA, A. Effects of reserpine on carbohydrate in aged people. *Rass. med. sper.*, 1956, **3**, 141-152.

PORTELLA, A. Reserpine and blood potassium. *Rass. med. sper.*, 1957, **4**, 29-34.

PORTELLA, A. Reserpine and the cortico-adrenal function. Observations in aged patients. *Rass. med. sper.*, 1957, **4**, 120-125.

POUGETOUX, J. and DEUTSCH, H. Study of neuromuscular excitability during the course of prolonged neuroleptic treatment (chlorpromazine and reserpine); technic, results, pathogenic considerations (in French). *J. med. Lyon*, 5 Nov. 1957, **38**(908), 927-942.

PRANJPE, A.S. *Rauwolfia serpentina* in hypertension. *Med. Bull.*, 1942, **10**, 135.

PRAYAG, V.S. Indigenous drugs in hypertension. *Maharashtra med. J.*, 1955, **2**, 320-22.

Present therapeutic trends in neuropsychiatry reserpine. *Sem. med. prof.* (Paris), 6 Mar. 1957, **33**(9), 387-388.

PREZIOSI, P. *R. serpentina* and hypertension (in Italian). *Rif. med.*, 9 May 1953, **67**(19), 528.

PRIETO, M. M. and SENET, O.J. Reserpine therapy of hypertension caused by acute glomerulonephritis (in Spanish). *Prensa med. argent.*, 10 Jan. 1958, **45** (2), 224-227.

Problems in the use of tranquilizing drugs. *Publ. Helth. Rept.* (Washington), Aug. 1956, **71**, 830-832 (includes reserpine).

Proceedings of the Symposium on reserpine and chlorpromazine in neuropsychiatry. *Arch. Psicol.*

Neurol. Psichiat., Mar.-June 1956, **17**(2-3), 115-684.

PROCTOR, R.C. et al. An analeptic tranquilizer for senile psychoses; report of clinical and pharmacological studies of nicozol with reserpine. *J. Amer. Geriat. Soc.*, Apr. 1958, **6**(4), 291-296.

PROUET, P.E. *Rauwolfia* and amphetamine therapy in the treatment of psychosomatic complaints. *J. Louisiana St. med. Soc.* (New Orleans), 1955, **107**(2), 114-6.

PURPURA, D.P. Electrophysiological analysis of psychotogenic drug action. I. Effect of LSD on specific afferent systems in the cat. *Arch. Neurol. Psychiat.* (Chicago), 1956, **72**(2), 122-31.

PUTZ, F. and SPIES, R. Combined therapy of malignant hypertension (in German). *Wien med. Wschr.*, 15 May 1954, **104**(20-21) 409-11.

RADOUCO-THOMAS, S. Action of noradrenaline and reserpine in experimental analgesia (in French). *Arch. exp. Path. Pharmak.*, 1957, **232**(1), 279-281.

RADOUCO-THOMAS, S. et al. Action of noradrenaline and reserpine in experimental analgesia (in French). *Arch. exp. Path. Pharmak.*, 1957, **232**(1).

RAKSHIT, B.B. Role of the *Rauwolfia* alkaloids in the treatment of hypertension in pregnancy. *J. Obstet. Gynaec.* (India), 1955, **6**, 184-197.

RAMA RAO, R. and SIRSI, M. *Rauwolfia* alkaloids in avian malaria (*P. Gallinaceum*). *Curr. Sci.*, 1956, **25**(11), 357.

RAMPRASAD, C. and SIRSI, M. Effect of *Rauwolfia* alkaloids on biliary secretion. *J. Indian med. Ass.*, 1957, **28**, 307-309.

RANADE, S. N. *Rauwolfia serpentina* (Serpina) in the syndrome of the irritable phallus. *Indian J. Pharm.*, 1956, **18**(7), 301-10.

RANADE, S.N. and RAJE, G.K. *Rauwolfia serpentina* in dermatological therapy. *J. Indian med. Ass.*, 1957, **29**, 100-102.

RANCE, A.M. et al. Therapy of psychiatric disorders by chlorpromazine and reserpine; comparative study of various modes of administration of these drugs (in French). *Encephale*, 1956, **45**(4), 477-487.

RANDOLPH, A.C. and THOMPSON, L.J. The use of dimethylane-reserpine combination in mental disorders; a preliminary report. *N.C. med. J.*, Jan. 1957, **18**(1), 17-20.

RASHKIS, H.A. and SMARR, E.R. Drug and milieu effects with chronic schizophrenics. *Arch. Neurol. Psychiat.* (Chicago), July 1957, **78**(1), 89-94.

RAULE, A. and LATTUADA, A. Treatment of arterial hypertension with *R. serpentina* alkaloids and in particular with reserpine (in Italian). *Ospedale Maggiore* (Milan), 1955, **43**(6), 245-64.

Rauwolfia. Sci. & Cult., 1955, **20**(12), 594. (Abst. from *J. ment. Sci.*, 1954, **96**, 491-95).

Rauwolfia and depressive states (in French). *Rev. Prat.*(Paris), 21 Nov. 1956, **6**(30), 3342.

Rauwolfia and reserpine. *J. Amer. med. Ass.*, 14 June 1958, **167**(7), 802-83.

Rauwolfia serpentina. Univ. Mich. med. Bull., 1953, **19**(10), 278-9.

Rauwolfia serpentina (Editorial). *Bull. Calcutta Sch. trop. Med.*, 1954, **1**(3), 22-23.

RAVETTA, A. *R. serpentina* in therapy of arterial hydertension (in Italian). *Minerva med.* (Torino), 11 Aug. 1954, **45**(63-64), 316-9.

RAVINA, A. Alkaloids of *Rauwolfia*, their hypotensive action (in French). *Pr. med.* (Paris), 7 Aug. 1954, **62**(54), 1125-6.

RAY, G.K. et al. Action of *R. serpentina* on vasomotor reflexes. *Arch. exp. Pathol. Pharmacol.*, 1953, **219**(4), 310-4.

RAY, G.K. et al. Sympathicolytic activity of *Rauwolfia serpentina*, Benth. *Indian J. med. Sci.*, 1953, **7**(5), 229-39.

RAYMOND, M.J. et al. Tranquillising drugs in psychoneurosis. *Brit. med. J.*, 1957, **ii**, 63 (includes *Rauwolfia* drugs).

RAYMOND-HAMET, M. Ajmaline, alkaloid from *R. serpentina* of selective paralysing action on vaso-constrictions reactive to adrenaline. *Bull. Sci. pharmacol.*, 1936, **43**, 364.

RAYMOND-HAMET, M. A curious physiological property of the aqueous extract of *Rauwolfia heterophylla* Roem and Sch. (in French). *C.R. Acad. Sci.* (Paris), 16 Aug. 1939, **209**, 384-386.

RAYMOND-HAMET, M. The direct and indirect intestinal effects of the extract of *Rauwolfia heterophylla*, Roem and Sch. (in French). *C.R. Acad. Sci.* (Paris), 16 Oct. 1939, **209**, 599-601.

RAYMOND-HAMET, M. Does *Rauwolfia vomitoria* Afzelius possess the therapeutic virtues attributed to it by indigenous healers? (in French). *Bull. Acad. Med.* (Paris), 4 July 1939, **122**, 30-38.

RAYMOND-HAMET, M. Intestinal effects of hydrosoluble active principles of *Rauwolfia vomitoria* Afzelius; influence on intestinal inhibition produced by epinephrine. *C.R. Soc. Biol.* (Paris), 1941, **135**, 627-631.

RAYMOND-HAMET, M. Monbasiana, new pharmacologically active false iboga, *Rauwolfia*

monbasiana (in French). *C.R. Acad. Sci.* (Paris), 10 June 1940, **210**, 789-791.

RAYMOND-HAMET, M. A new selective paralysing agent for insensitive adrenal vasoconstrictions —ajmaline, a crystallised alkaloid of *Rauwolfia serpentina* (in French). *Bull. Acad. Med.*, 1936, **115**, 452.

RAYMOND-HAMET, M. A new sympathicolytic true *Rauwolfine* of Koepfli (in French). *C.R. Acad. Sci.* (Paris), 1935, **201**, 1050-1053.

RAYMOND-HAMET, M. Physiologic properties of total alkaloids of roots of *Rauwolfia vomitoria* Afzelius. *C.R. Soc. Biol.*(Paris), 1944, **138**, 40-14.

RAYMOND-HAMET, M. *Rauwolfia heterophylla* effects of extract of *Rauwolfia heterophylla*, Roem and Sch. on cardiac vagus nerv. *C.R. Soc. Biol.* (Paris), 1939, **132**, 213-216.

RAYMOND-HAMET, M. Serpentina, influence of serpentinine (alkaloid of *Rauwolfia serpentina*) on effects of epinephrine, carotid occlusion and faradization of vagus. *C.R. Acad. Sci.*(Paris), Nov. 1940, **211**, 414-416.

RAYMOND-HAMET, M. Serpentina, intestinal effects of pure ajmaline. *C.R. Soc. Biol.*(Paris), 1940, **134**, 369-372.

RAYMOND-HAMET, M. Some physiological properties of an alkaloid of *R. serpentina*, Benth., isorauhimbine of Hofmann. *C.R. Soc. Biol.* (Paris), 1956, **150**, 879.

RAYMOND-HAMET, M. Some physiological properties of the pure ajmaline of Siddiqui. *C.R. Acad. Sci.* (Paris), 1957, **245**, 2113-2115.

RAYMOND-HAMET, M. Some physiological properties of serpentine, a crystalline alkaloid of *R. serpentina*, Benth. *C.R. Soc. Biol.* (Paris), 1940, **134**, 94-96.

RAYMOND-HAMET, M. Stereoisomerism limited to one of the centres of a molecule may be accompanied by marked differences of physiological activity. *C.R. Acad. Sci.* (Paris), 1955, **241**(25), 2009-2011.

RAYMOND-HAMET, M. Tensor and vascular effects of one of the alkaloids from *Rauwolfia serpentina*, Benth. (in French). *C.R. Acad. Sci.* (Paris), 1946, **223**, 927-929.

RAYNAUD, R. and D'ESHOUGNES, J.R. Ganglion-blocking agents, hydrazinophthalazines and active principles of *R. serpentina* in the treatment of arterial hypertension (in French). *Algerie med.* 1955, **59**(1), 49-54.

REA, E.L. and FAZEKAS, J.F. Effects of parenterally administered reserpine. *Arch. intern. Med.*, 1955, **95**(4), 538-39.

REDISCH, W. et al. Interrelationship of drugs influencing arterial pressure in man. *Circulation*, Feb. 1958, **17**(2), 208-212 (includes reserpine).

REDLEAF, P.D. and TOBIAN, L. Sodium restriction and reserpine administration in experimental renal hypertension; a correlation of arterial blood pressure responses with the ionic composition of the arterial wall. *Circulation Res.*, May 1958, **6**(3), 343-351.

REDMAN, K. *Rauwolfia* and hypertension. *Sth. Dakota J. Pharm.*, 1955, **8**(7), 250-4.

REHDER, K. Action of reserpine on the cough reflex in cats (in German). *Klin. Wschr.*, 1957, **35**, 642-643.

REICHELT, J. Contribution to the analysis of reserpine. *Ceskoslv. Farms.*, 1956, **5**(9), 516-519.

REIN, C. R. and GOODMAN, J.J. Efficacy of reserpine (Serpasil) in dermatological therapy. *Arch. Derm. Syph.* (N.Y.), Dec. 1954, **70**(6), 713-7.

REIN, C.R. and GOODMAN, J.J. The tranquilizing efficacy of reserpine in dermatological therapy. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 230-5.

REISNER, H. Cases of administration of massive doses of reserpine (in German). *Wien Klin. Wsch.*, 2 Nov. 1956, **68**(44), 872-874.

REMIEN, H. Indications of *Rauwolfia serpentina* therapy in medical practice (in German). *Medizinische*, 20 Nov. 1954, No. 47, 1578-81.

Reserpine. *Pfizer Technical Bull.*, No. 81.

Reserpine and the mind. *Lancet.*, 13 Aug. 1955, **269**, 320-1.

Reserpine and the nervous system. *Lancet*, 24 Dec. 1955, **269**, 1326.

Reserpine; development and future perspective. *Int. Rec. Med.*, Apr. 1957, **170**(4), 214-219.

Reserpine in radioactive form made at Argonne Laboratory. *Oil Paint Drug Reptr.*, 3 Sept. 1956, **170**, 5.

Reserpine thyrotoxicosis. *Brit. J. Med.*, 22 Feb. 1958, 450-451.

REUBI, F. et al. Circulatory effect of reserpine (Serpasil) (in French). *Helv. med. acta* (Basel), Oct. 1954, **21**(21-5), 493-7.

RIBARI, O. Effect of reserpine on atrophic processes of the nasal mucosa (in Hungarian). *Ful. orrgegegyogy.*, Dec. 1957, No. 4, 184-186.

RICCI, E. The pharmacology of *Rauwolfia serpentina* (In Italian). *Rass. int. clin. Ter.*, 15 Mar. 1955, **35**(5), 169-177.

RICCI, G.C. and RICORDATI, M. Physiopathological and clinicotherapeutic effects of a *R. serpentina*, Benth. alkaloid and its total extracts. I. Com-

parative tests of blood-sugar changes induced in normal and hyperglycemic subjects by reserpine, total extracts, glucose, insulin and adrenaline in various combinations (in Italian). *Arch. E. Maragliano*, Aug. 1955, **11**(1), 359-401.

RICCI, G.C. and RICORDATI, M. *Rauwolfia serpentina* alkaloid in the treatment of hypertension and of certain psychopathies; critical considerations and clinical experiences (in Italian). *Rass. Fisiopat. clin. Terap.*, 1954, **26**(1-2), 91-131.

RICCI., G.C. et al. Somatic modifications induced by prolonged use of reserpine in large doses in psychiatric therapy (in Italian). *Riv. pat. nerv. ment.*, 1956, **77**(2), 621-622.

RICHARD, R. W. Some modern hypotensive agents. *Pharm. J.*, 1954, **172**, 269-71 (incl. *R. serp.*).

RICHMAN, A. and TYHURST, J.S. An extrapyramidal syndrome with reserpine. *J. Canad. med. Ass.*, 15 Mar. 1955, **72**(6), 457-8.

RIDER, J.A. Effect of prolonged administration of reserpine (Reserpod) on gastric secretion. *Proc. Soc. exp. Biol.* (N.Y.), 1955, **90**, 636.

RIDER, J.A. et al. The effect of reserpine on gastric secretion and its possible site of action. *Gastroenterology*, 1957, **33**(5), 737-744.

RIECHERT, W. and ESCHBACH, O. Influence of reserpine on egg white edema in rat paw (in German). *Arzneimittel-Forschung*, 1955, **5**(5), 295-6.

RINALDI, F. and HIMWICH, H E. A comparison of effects of reserpine and some barbiturates on the electrical activity of cortical and subcortical structures of the brain of rabbits. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 27-35.

RINALDI, F. and HIMWICH, H.E. Drugs affecting psychotic behaviour and the function of the mesodiencephalic activating system. *Dis. nerv. Syst.*, 1955, **16**(5), 133-41.

RINALDI, F. et al. Clinical evaluation of azacyclonol, chlorpromazine and reserpine on a group of chronic psychotic patients. *Amer. J. Psychiat.*, 1956, **112**(9), 678-83.

RINDANI, T.H. Action of reserpine-free extract of *Rauwolfia serpentina* on hypophysis-adrenocortical axis in rat. *Arch. int. Pharmacodyn.*, 1 Aug. 1955, **102**(4), 465-9.

RINDANI, T.H. Influence of reserpine frees extract of *Rauwolfia serpentina* on the action of ACTH and cortisone acetate in rats. *Arch. int. Pharmacolodyn.*, 1 Oct. 1956, **108**(1), 51-54.

RINDANI, T.H. *Rauwolfia serpentina* in stress. *Indian J. Pharm.*, 1956, **18**(7), 317.

RINDANI, T.H. and ANTIA, F.R. Effect of reserpine-free extract of *Rauwolfia serpentina* on gastric acidity in man. *Indian J. med. Sci.*, 1957, **11**, 479-82.

RIO IBANEZ, J. DEL and RIUZ GIJON, J. Pharmacological studies on *Rauwolfia serpentina*, Benth. *Ann. Inst. Farmacol. esp.*, 1955, No. 5, 327-364.

RIOPELLE, A. J. and PIEFFER, C.C. Effects of acute and chronic administration of reserpine on test performance. *Arch. Neurol. Psychiat.* (Chicago), Mar. 1958, **79**(3), 352-358.

RIOS, G. *Rauwolfia serpentina* alkaloids in hypertension in pregnancy (in Spanish). *Rev. esp. Obstet. Ginec.* (Valencia), July-Aug. 1956, **15**(88), 220-224.

RIOS MOZO, M. Reserpine in therapy of arterial hypertension (in Spanish). *Hisp. med.*, Aug. 1954, **11**(22), 339-43.

RITTER, N.S. Experience with reserpine in the treatment of alcoholism. *Quart. Stud. Alc.*, June 1956, **17**(2), 195-7.

RITTER, O. and HUNGUENIN, J.C. Clinical tests with reference to the action o` serpasil in severe arterial hypertension (in French). *Praxis*, 18 Mar. 1954, **43**(11), 228-32.

RIVEN, S.S. and WELLS, J.G. Use of drugs in the management of hypertension. *J. Tenn. St. med. Ass.* (Nashville), **47**(1), 1-10.

RIVOLTA, A. and GAMMA, G. Good results obtained with ACTH in extrapyramidal disorders caused by reserpine (in Italian). *Riv. sper. Freniat.*, 1 July 1957, **81**(2), 461-466.

RIZZENTE, S. et al. Clinical observations on a new hypotensive agent in geriatrics (in Italian). *Gi. Clin. med.*, May 1955, **36**(5), 669-78.

ROBINSON, B. Breast changes in the male and female with chlorpromazine or reserpine therapy. *Med. J. Aust.*, 1957, **44**(2)/7, 239-241.

RODARI, T. Combination of *Rauwolfia serpentina* and a new xanthine derivative in the treatment of hypertension (in Italian). *Minerva med.* (Torino), 10 Feb. 1957, **48**, 452-457.

ROGERS, S.F. et al. Management of toxemia of pregnancy with reserpine. I. Maternal effects. *Obstet. Gynec.*, July 1957, **10**(1), 17-27.

ROJAS, A.T. Serpasil in intraspinal administration in states of agitation (in French). *Psychiatria* (Basel), May 1957, **133**(5), 285-290.

ROMERO, E. Treatment of arterial hypertension with reserpine; report of cases (in Spanish). *Rev. clin. esp.*, 15 May 1954, **53**(3), 237-43.

ROSENBERG, C.M. Treatment of psychomotor epileptics with reserpine. *Ohio med. J.*, Apr. 1957, **53**(4), 405-408.

ROSENBLUM, S. et al. Effects of tranquilizing medication (reserpine) on behaviour and test performance of maladjusted, high-grade retarted children. *Amer. J. ment. Defic.*, Jan. 1958, **62**(4), 663-671.

ROSINA, P.L. Total *Rauwolfia* alkaloids in psychiatry; physiological premises and clinical tests (in Italian). *Minerva med.* (Torino), 7 Nov. 1955, **46**(89), 1249-52.

ROSNER, H. et al. A comparative study of the effect on anxiety of chlorpromazine, reserpine, phenobarbitol and a placebo. *J. nerv. & ment. Dis.*, Dec. 1955, **122**(6), 505-12.

ROSS, J.H. and WRIGHT, J.A. Successful twin pregnancy after treatment of malignant essential hypertension. *Brit. med. J.*, 30 Aug. 1958, 545-547 (includes treatment with reserpine).

ROSS, M.S. Drug eruption from *Rauwolfia serpentina*. *Arch. Derm. Syph.*, N.Y., Mar. 1957, **75**(3), 439.

ROSSI, G.V. et al. The effects of reserpine and meprobamate on gastric acid secretion. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1957, **46**, 455-458.

ROTHMAN, S. et al. Pharmacological studies with pseudoreserpine and raunescine, two alkaloids isolated from *Rauwolfia canescens*, Linn. *Proc. Soc. exp. Biol.* (N.Y.), 1957, **95**, 789-791.

ROWLAND, F. S. and NUMEROF, P. Radioactive labelling of reserpine by tritium recoil. *Int. J. Appl. Radio Isotopes* (N.Y.), Jan. 1957, **1**(4), 246-8.

ROY CHOWDHURY, A.K. and GHOSH, S.M. A preliminary report on the treatment of hypertension by isolated pure alkaloid of *R. serpentina*. Pt. I. *Indian med. Forum*, 1953, **4**(6), 177-187.

ROY, P.C. *Rauwolfia serpentina*. *Patna med. J.*, 1931, **4**, 131.

ROY, P.K. Effects of *R. serpentina* on maniac patients. *Indian J. Neurol. Psychiat.*, 1950, **2**, 59.

ROY, P.K. Use of *R. serpentina* in psychiatry. *Indian J. Neurol. Psychiat.*, 1952, **3**(4), 380-398.

RUBIN, B. and BURKE, J.C. Mouse prosis bioassay of *R. serpentina* for reserpine-like activity. *Fed. Proc.*, 1954, **13**, 400.

RUIZ GIJON, J. and RIO IBANEZ, J. DEL. Studies on *Rauwolfia serpentina*, Benth. and its alkaloids. II. (in Spanish). *Farmacognosia*, July-Sept. 1955, **15**(37), 221-59.

RUSKIN, I.W. and AVOL, M. *Rauwolfia* tranquilization for the disturbed aged. *J. Amer. Geriat. Soc.*, Oct. 1956, **4**(10), 998-1003.

SAARENMAA, E. On the effect of reserpine on serum protein-bound iodine (PBI). *Acta chir. Scand.*, 28 Mar. 1957, **112**(3-4), 199-208.

SACERDOTI, G. First experiments in neuropsychiatry with a new alkaloid of *R. serpentina*, Serpasil; preventive note (in Italian). *Gazz. med. ital.* (Torino), 1955, **114**(3), 63-5.

SACERDOTI, G. and MANTELLI, A. Reserpine in the ambulatory treatment of behavior disorders in childhood (in Italian). *Gazz. med. ital.* (Torino), 1955, **114**(9), 189-91.

SACERDOTI, G. and VEGRO, G.R. Tramer reflex and automatic balance during reserpine treatment in children (in Italian). *Z. kinderpsychiat.*, Oct. 1956, **23**(5), 153-157.

SACHDEV, K.S. and AIMAN, R. Potentiation of histamine response of guinea pig ileum by serpentine. *Curr. Sci.*, 1957, **26**, 356-357.

SAILER, S. and STUMPF, CH. Effect of reserpine on the electroencephalogram in the rabbit. *Arch exp. Path. Pharmak.*, 1957, **230**, 378-385.

ST. JAMES, A.T. and RYAN, A.J. Reserpine therapy producing massive gastric and duodenal hemorrhage. *Conn. med. J.*, May 1957, **21**, 418-419.

SAINZ, A.A. The management of side effects of chlorpromazine and reserpine. *Psychiat. Quart.*, Oct. 1956, **30**(4), 647-653.

SAINZ, A.A. Use of reserpine in ambulatory and hospitalized geriatric psychotics. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **16**(1), 72-7.

SALERA, A.M. and LEFEVRES, E. Serpasil in the treatment of various diseases in the field of psychiatry (in Spanish). *Prensa med. argent.*, 19 July 1957, **44**(29), 2282-2824.

SALMOIRAGHI, G.C. and PAGE, I.H. Effects of LSD 25, BOL 148, bufotenine, mescaline, and ibogaine on the potentiation of hexobarbital hypnosis produced by serotonin and reserpine. *J. Pharmacol.*, 1957, **120**, 20-25.

SALMOIRAGHI, G. C. et al. Blockade by bromlysergic-acid-diethylamide (BOL) of the potentiating action of serotonin and reserpine on hexobarbital hypnosis. *J. Pharmacol.*, June 1956, **117** (2), 163-8.

SAMUELS, S. S. The vasodilating action of *R. serpentina*. *Angiology*, Feb. 1956, **7**(1), 86-7.

SANABRIA, A. *Rauwolfia* in the treatment of essential hypertension (in French). *Arch. Mal. coeur.*, June 1956, **49**(6), 573-575.

SANO, I. Urinary excretion of 5-hydroxyindoleacetic acid in schizophrenic patients. Study of influence of chlorpromazine and reserpine on metabolism of Serotonin (in German). *Schweiz. med. Wschr.*, 2 Mar. 1957, **87**, 214-217.

SAPIR, M. et al. Psychosomatic action of chlorpromazine and reserpine (in French). *Encephale*, 1956, **45**(4), 488-493.

SARWER-FONER, G.J. Psychoanalytic theories of activity-passivity conflicts and of the continuum of ego defenses; experimental verification, using reserpine and chlorpromazine. *Arch. Neurol. Psychiat.* (Chicago), Oct. 1957, **78**(4), 413-418.

SARWER-FONER, G.J. and OGLE, W. The use of reserpine in an open psychiatric setting. *J. Canad. med. Ass.*, 1 Aug. 1955, **73**(3), 187-91.

SAUL, G.D. and SAWEY, C.H. Atropine blockade of electrically induced hypothalmic activation of the rabbit adenohypophysis. *Fed. Proc.*, Mar. 1957, **16**, 112. (Abstract: includes reserpine).

SAVAGE, C. and DAY, J. Effects of a tranquilizer (reserpine) on psychodynamic and social processes. *Arch. Neurol. Psychiat.* (Chicago), May 1958, **79**(5), 590-596.

SAYIL, T.A. Hypotension therapy in hypertension (in Turkish). *Turk tip cemiy. mecmuasi.*, Dec. 1957, **23**(12), 648-653 (includes reserpine).

SBARBI, M.A. and MENGONI, J.F. Reserpine treatment of various cases of neurosis and psychosis (in Spanish). *Prensa med. argent.*, 11 Jan. 1957, **44**(2), 121-122.

SCALFI, L. et al. First case report on the use of reserpine in the treatment of peripheral vascular disease (in Italian). *G. Clin. med.*, Nov. 1956, **37**(11), 1635-1642.

SCHAUFELE, D. and NOHARA, F.S. Chemistry and pharmacology of a new ganglion blocking agent, plegarol, and the hypotensive agent, ranpyrol, in combination with rescinnamime (in German). *Praxis*, 13 Mar. 1955, **47** (11), 268-270.

SCHEURLE, G. The treatment of chronic schizophrenia with reserpine (in German). *Dtsch. med. Wschr.*, 27 Dec. 1957, **82**, 2226-2227.

SCHEURLE, G. Do the side effects of reserpine have therapeutic significance? (in German). *Dtsh. med. Wschr.*, 27 Dec. 1957, **82**, 2227-2229.

SCHIFIS M. and BASTAROLI, J.C. Clinical tests of combined *Rauwolfia*, bromocholiline bromide and papaverine hydrochloride in the treatment of arterial hypertension (in Spanish). *Dia. Med.* (B. Aires), 26 May 1958, **30**(33), 1151.

SCHINDEL, L. Reserpine antagonists. *Folia pharm.* (Istanbul), 1957, **4**(1), 307-315.

SCHIPA, S. Pharmacological and pharmacodynamic bases of neuroganglioplegic therapy (in Italian). *Osped. psichiat.*, Jan.-Mar. 1956, **24**(1), 75-90 (includes reserpine).

SCHLAGEL, C.A. and NELSON, J.W. The blood pressure lowering ability of some fractions of *R. serpentina*, Benth. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1954, **43**(8), 505-10.

SCHLAGEL, C.A. and NELSON, J.W. *Rauwolfia* hypotension. 2 Pts. Role of the vagus and carotid afferent nerves. *J. Amer. pharm. Ass. (Sci. Ed.)*, 1957, **46**, 98-109.

SCHLUETER, E.A. Nitranitol—*R. serpentina* in the combined therapy of hypertension. *Ohio St. med. J.*, 1955, **51**(2), 130-2.

SCHMIDT, K. Thrombopenia after reserpine therapy (in German). *Wien. klin. Wschr.*, 11 Jan. 1957, **69**(2), 27-29.

SCHMIDT, K.E. Combined treatment with chlorpromazine and reserpine. *J. ment. Sci.*, Jan. 1957, **54**(4), 200-208.

SCHMITT, HENRI and GONNARD, PIERRE. Pharmacological study of raubasine, an alkaloid of *Rauwolfia serpentina*, Benth. *Therapie*, 1957, **12**, 274-279.

SCHMITT, HENRI and NECHTSCHEIN, S. Study of the action of rescinnamine (reserpine) on the central nervous system (in French). *J. Physiol.* (Paris), Jan.-Feb. 1958, **50**(1), 75-89.

SCHMITT, HENRI and SCHMITT, HELENE. Action of alkaloids of *Rauwolfia serpentina* on the pseudomadness of the hypothalamic cat and on the rigidity of the decerebrate cat. *C.R.Soc. Biol.* (Paris), 1957, **151**, 60-62.

SCHMITT, HENRI and SCHMITT, HELENE Central actions of raubasine. (Δ Yohimbine). *Therapie*, 1958, **13**(2), 246-250.

SCHMITT, HENRI, and SCHMITT, HELENE. Inhibition by reserpine of the cardiovascular effects of the sympathetic system (in French). *C.R. Acad. Sci.* (Paris), 1957, **245**, 2426-2428.

SCHMITT, HENRI and SCHMITT, HELENE. Potentiations by reserpine and resinnanime of the cardiovascular and respiratory effects of veratrine. *C.R. Acad. Sci.* (Paris), 1957, **244**, 520-522.

SCHNEIDER, E.M. and CLARK, M.L. Gastric secretion as influenced by *Rauwolfia* alkaloids. *Ann. intern. Med.*, Oct. 1957, **47**(4), 640-650.

SCHNEIDER, E.M. and CLARK, M.L. Hyperchlorhydria induced by intravenous reserpine; response to various therapeutic agents. *Amer. J. Digest. Dis.*, 1956, **1**(1), 22-30.

SCHNEIDER, G. The indications for various tranquilizing agents and results obtained in the psychiatric clinic of Laussane (in French). *Encephale*, 1956, **45**(4), 1024-1030 (includes reserpine).

SCHNEIDER, J.A. Further characterization of the central effects of reserpine (Serpasil). *Amer. J. Physiol.*, 1955, **180**(3), 64-9.

SCHNEIDER, J.A. Reserpine antagonism of morphine analgesia in mice. *Proc. Soc. exp. Biol.* (N.Y.), Dec. 1954, **87**(3), 614-5.

SCHNEIDER, J.A. and EARL, A.D. Behaviour and electroencephalographic studies with serpasil (reserpine), a new alkaloid from *R. serpentina*. *Fed. Proc.*, 1954, **13**, 130.

SCHNEIDER, J.A. and EARL, A.E. Effects of serpasil on behaviour and autonomic regulating mechanisms. *Neurology*, 1954, **4**(9), 657-67.

SCHNEIDER, J.A. and RINEHART, R.K. Circulatory interactions of serotonin (5-HT)., and reserpine (R) in dogs. *Arch. int. Pharmacodyn.*, 1956, **105**, 253-268.

SCHNEIDER, J.A. et al. Neuropharmacological aspects of reserpine. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 17-26.

SCHNEIDER, R.A. Acute effects of reserpine and of amytal on central sympathetic reactivity. *Anr. N.Y. Acad. Sci.*, 15 Apr. 1955, **16**(1), 150-60.

SCHNEIDER, R. A. et al. Pharmacodynamics of postural hypertension (*Rauwolfia*). *Clin. Res. Proc.*, 1954, **2**, 69.

SCHNEIDER, W. Study on *Rauwolfia* alkaloids from their first use to the present (in German). *Arzneimittel-Forchung*, 1955, **5**(11), 666-72.

SCHNYDER, U. W. and SCHAUWECKER, R. Largactil and serpasil in dermatology (in French). *Dermatolgica* (Basel), Oct. 1955, **111**(4), 185-97.

SCHROEDER, H. A. and DAVIES, D. F. Studies on "essential" hypertension. V. An endocrine syndrome. *Ann. intern. Med.*, 1954, **40**, 516.

SCHRUT, A. H. Controlled study on clinical use of reserpine in psychotic patients with special comments on sources of error. *J. nerv. ment. Dis.*, Dec. 1955, **122**(6), 513-7.

SCHUMANN, H. Effects of hypotensive drugs on stroke volume and vascular resistance in hypertension. II. Reserpine (Serpasil-Ciba) and its combination with Nepresol (in German). *Klin. Wschr.*, 1 Mar. 1954, **32**(9-10), 220-4.

SCHUMANN, H. Mechanism of action of a new conservative therapy of mitral stenosis with reserpine (in German). *Klin. Wschr.*, 1 Feb. 1955, **33**(5-6), 124-6.

SCHUMANN, H. A new conservative therapy of mitral stenosis and other cardiac damages with reserpine (in German). *Z. Kriesl Forsch.*, Sept. 1954, **43**(17-18), 614-24.

SCHUMANN, H. On the problem of practical use of medicinal therapy of hypertension (in German). *Medizinische*, 10 Apr. 1954, No. 15, 498-503.

SCHUMANN, H. and REHBERG H. G. A new treatment with reserpine for the chronically injured heart (in German). *Medizinische*, 3 Dec. 1955, No. 49, 1704-7.

SCHUMANN, H. J. The action of insulin and reserpine on the adrenalin and ATP content of the chromaffin-granules of the medulla of the suprarenal gland (in German). *Arch. exp. Path. Pharmak.*, 1958, **233**, 237-249.

SCHUMANN, H. J. Storage of adrenalin and noradrenalins in the chromaffin granules of the medulla of the suprarenal gland, and the influence of reserpine and insulin (in German). *Arch. exp. Path. Pharmak.*, 1957, **232**(1), 285-285.

SCHWARTING, G. Practical remarks on combined treatment of hypertension with *Rauwlofia* alkaloids and ganglion blocking agents (in German). *Med. Klin.* (Berlin), 7 Feb. 1958, **53**(6), 218-224.

SCHWARTZ, A. et al. Clincal aspects of the use of the hypotensive drugs in therapy of arterial hypertension (in Protuguese). *Rev. paulist. Med.*, Jan. 1957, **50**(1) 28-43.

SCHWARTZBAUM, J. S. Effects of reserpine and chlorpromazine on nest building and thermal preference in rats. *Proc. Soc. exp. Biol.* (N.Y.), Oct. 1955, **90**(1), 275-7.

SEEMANN, D. Reserpine management in geriatrics (in German). *Wien. med. Wschr.*, 3 Nov. 1956, **106**(44), 930.

SEGAL, M. S. and ATTINGER, E. O. The use of reserpine as an adjunct in the management of patients with chronic bronchial asthma and chronic pulmonary emphysema: preliminary studies. *Ann. N. Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 267-75.

SELLERS, A. M. and HAFKENSCHIEL, J. H. Sedative and antihypertensive effect of intravenous reserpine in man. *Fed. Proc.*, 1954, **13**,404.

SEN, G. and BOSE, K. C. *Rauwolfia serpentina. Indian med. World*, 1931, **2**, 194 (reports the presence of two alkaloids with different m.p's. in addition to other organic and inorganic matters, and studies the pharmacological action of the drug on higher animals, e.g. cats).

SEN, G. P. et al. Effect of pretreatment of *Rauwolfia* alkaloids on fluorescence and alkaloid concentration of countercurrent distribution fractions. *Bull. Calcutta Sch. trop. Med.*, 1957, **5**, 66.

SENECA, H. Rheumatoid arthritis complicated by severe ulcerative colitis, successfully treated with prednisone and *Rauwolfia*. A case history. *J. Amer. Geriat. Soc.*, 1956, **4**(6), 613-5.

SERGIO, C. and ALEMA, G. Behaviour of experimental catatoma induced by bulbocapnine in rats under the action of various drugs. IV.

Action of reserpine (in Italian). *Boll. Soc. ital. Biol. sper.*, Mar. 1957, **33**(3), 288-290.

Serpasil. *Farmaco, Edizione Pratica* (Pavia), Aug. 1954, **9**(8),424-5.

SETH, A. K. and VIRENDAR NATH. Reserpine (Serpasil) in minor psychiatry. *Indian J. med. Sci.*, 1956, **10**, 193-94.

SETH, S. C. et al. Clinical study with a new fraction of *Rauwolfia serpentina* in the treatment of essential hypertension. *Curr. med. Pract.*, 1958, **2**, 191-202.

SHAPIRO, A. P. et al. Technic of controlled drug assay illustrated by a comparative study of *Rauwolfia serpentina*, phenobarbital and placebo in the hypertensive patient. *New. Engl. J. Med.*, 23 May 1957, **256**(21), 970-975.

SHAPIRO, J. Serpasil—its use as a sedative in certain disturbed mental patients. *J. Okl. St. med. Ass.*, June 1955, **48**(7), 171-3.

SHELBY, R.W. Use of a new drug combination (pentoxylon) in angina pectoris and status anginosus. *J. Amer. Osteopat. Ass.*, Jan. 1955, **54**(5), 290-4.

SHELDON, M. B. and KOTTE, J. H. Effect of *Rauwolfia serpentina* and reserpine on the blood pressure in essential hypertension; a long term double blind study. *Circulation*, Aug. 1957, **16**(2), 200-206.

SHEPPARD, H. Brain reserpine levels following large and small doses of reserpine-H3. *Proc. Soc. exp. Biol. (N.Y.)*, 1957, **97**(4), 717-721.

SHEPPARD, H. and TSIEN, W.H. Metabolism of reserpine-C 14. II. Species differences as studied in vitro. *Proc. Soc. exp. Biol. (N.Y.)*, Nov. 1955, **90**(2), 437-40.

SHEPPARD, H. and WATT, D.C. A controlled clinical study of chlorpromazine and reserpine in chronic schizophrenic. *J. Neurol. Psychiat.*, Aug. 1956, **19**(3), 232-235.

SHEPPARD, H. et al. Inhibition of acetylcholine-esterase by reserpine in suspension. *Nature*, 1957, **179**,587-588.

SHEPPARD, H. et al. Metabolism of reserpine-C.3. C14-concentration versus amine in the brains and other tissues of rats and guinea pigs. *Arch. int. Pharmacodyn.*, 1957, **113**, 160-168.

SHERMAN, C.C. Nursing aspects. *Amer. J. Nurs.*, 1955, **55**(12), 1467-8. (Reserpine in mental disorders).

SHERMAN, W.C. et al. Nutritional studies of hydroyzine and *Rauwolfia* in cattle and lambs. *Proc. Soc. exp. Biol. (N.Y.)*, 1958, **98**(1), 91-94.

SHORE, P. A. Effects elicited by reserpine in rabbit pretreated with iproniazid. *Proc. Soc. exp. Biol. (N.Y.)*, 1957, **94**, 433-435.

SHORE, P. A. et al. Interaction of reserpine, serotonin, and lysergic acid diethylamide in brain. *Science*, 12 Aug. 1955, **122**(3163), 284-5.

SHORE, P.A. et al. Mechanism of serotonin-release by reserpine. *Fed. Proc.*, Mar. 1956, **15**, 483-484 (abstract).

SHORE, P. A. et al. Release of brain norepinephrine by reserpine. *Fed. Proc.*, Mar. 1957, **16**, 335-336 (abstract).

SHORE, P. A. et al. Release of blood platelet serotonin by reserpine and lack of effect on bleeding time. *J. Phamacol.*, 1956, **117**, 232-6.

SHORE, P. A. et al. Role of brain serotonin in reserpine action. *Ann. N.Y. Acad. Sci.*, 1957, **66**, 609-617.

SIEGEL, B. V. and LIBET, B. Central depressant drugs in neurotropic virus diseases. *Arch. int. Pharmacodyn.*, 1957, **111**, 145-154 (includes reserpine).

SIGG, E. B. and SCHNEIDER, J. A. Mechanisms involved in the interaction of various central stimulants and reserpine. *Electroenceph. Clin. Neurophysiol.*, Aug. 1957, **9**(3), 419-426.

SIGG, E. B. et al. Synergism of amines and antagonism of reserpine to morphine analgesia. *Proc. Soc. exp. Biol. (N.Y.)*, 1958, **97**, 97-100.

SILVA-MALTEZ, J. Treatment of hypertensive disease; experiment with reserpine plus 1.4-dihydrazinophthalazine (adephan) (in Portuguese). *J. Med., Porto*, 21 July 1956, **30**(704), 593-598.

SILVERBERG, J.W. and GRALNICK, A. Possible synergistic action of chlorpromazine, reserpine and frequel; a preliminary report. *Amer. J. Psychiat.*, Aug. 1957, **114** (2), 173.

SIMKO, K. Ambulant treatment of diseases with sedaraupin (reserpine) (in German). *Medizinische*, 23 Mar. 1957, No.12, 423-426.

SIMKO, A. The psychotherapeutic principles of reserpine treatment of schizophrenia (in German). *Psychiat. Neurol. med. Psychol.*, Feb. 1958, **10** (2), 45-53.

SIMKO, A. Undesirable clinical side-effects of reserpine and their prevention (in German). *Z. arztl. Fortbild.*, 1 Jan. 1958, **52** (1), 9-14.

SIMONINI, G. and JARIA, A. Use of reserpine and total alkaloids in *Rauwolfia serpentina* enuresis (in Italian). *Rass. Studi. psichiat.*, 1956, **45** (5), 1182-1183.

SINGH, H.N. Observations in antihypertensive therapy with reserpine and dihydrazinophthalazine combination. *Indian Practit.*, 1958, **11**, 901-908.

SIRSI, M. and TIRUNARAYANAN, M.O. Antibacterial activity of *Rauwolfia* alkaloids. *Curr. Sci.*, 1955, **24**(6), 185-86.

SIRSI, M. et al. Effect of *Rauwolfia* alkaloids on some endocrine functions. *Curr. Sci.*, 1955, **25** (1), 15-16.

SIRSI, M. et al. Observations on the pharmacology of *Rauwolfia* alkaloids. *Indian med. Rec.*, 1956, **76**, 228-32.

SLATER, I.H. et al. Pharmacological properties of reserpine. A new alkaloid from *Rauwolfia canescens*, Linn. *Proc. Soc. exp. Biol.* (N.Y.), 1955, **88**, 293-295.

SLOER, M. and BEREZOVSKY, M.R. Combined treatment of arterial hypertension; 1-hydrazinophthalazine + reserpine (in Spanish). *Prensa med. argent.*, 5 Apr. 1957, **44**(14), 1081-1085.

SLUGA, W. and SPIEL, W.A. *Rauwolfia* preparation in neurological indications in children (in German). *Arztl. Wschr.*, 31 May, **12**(22), 491-495.

SMIRK, F.H. and MCQUEEN, E.G. Comparison of reserpine and rescinnamine as hypotensive agents. *Lancet*, 16 July 1955, **269**, 115-6.

SMIRK, F.H. et al. Control of blood pressure by combined action of reserpine and pentapyrroloidinium. *Lancet*, 24 July 1954, **267**, 159-62.

SMITH, C.W. and THOMAS, G. The use of a combination of hypotensive agents in mild and moderately severe hypetension. *Amer. Practit.* June 1957, **8**(6), 920-923 (includes reserpine).

SMITH, K. et al. Effect of chlorpomazine, reserpine and frenquel on convulsive threshold. *Confinia neur.* (Basel), 1958, **18**(1), 26-31.

SMITH, R.P. et al. Effects of reserpine on conditioned avoidance behaviour in normal and brain-operated monkeys. *J. Pharmacol.*, 1956, **117**, 136-41.

SMITH, R.P. et al. Effects of some tranquilizing and depressant drugs on conditioned avoidance of behaviour in monkeys. *J. Pharmacol.*, 1957, **119**, 317-327 (includes reserpine).

SMITH, S.K. Use of reserpine in private psychiatric practice. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 206-10.

SMYTH, V.O.G. The use of reserpine in psychiattry. *Med. J.* (Malaya), Mar. 1957, **11** (3), 228-234.

SOEHRING, K. 5-Hydroxytryptamine and *Rauwolfia* action. *Planta Med.*, 15 Dec. 1957, **5**(56), 182-185.

SOGLIANI, G. Sleep therapy with chlorpromazine and *Rauwolfia;* posology, combinations and comparisons (in Italian). *Minerva med.* (Torino), 7 Nov. 1955, **46**(89), 1253-9.

SOLIMAN, E. and SALAM, R.A. *Rauwolfia serpentina* and the modern management of hypertension. *J. Egypt. med. Ass.*, 1955, **38**(5), 327-41.

Some aspects of the treatment of hypertension with *R. serpentina. Bull. Calcutta Sch. trop. Med.*, 1954, **2** (1), 22.

SOMMERNESS, M.D. et al. A controlled study of reserpine on chronically disturbed patients. *Arch. Neurol Psychiat.* (Chicago), Sept. 1955, **74**(3), 316-9.

SOTOARRI TU, P. and FIGUERIDO-SANTURTUN, J.A. Intrathecal reserpine—our experience in 50 cases (in Spanish). *Acta Luso-esp. Neurol.*, 1957, **16** (4), 305-307.

SOUDER, C. L. The use of thorazine and serpasil in neurological cases. *Delaware St. med. J.*, Aug. 1956, **28**(8), 195-196.

SOVA, J. et al. Hemodynamics of hypertensive patients under the influence of hypotensive substances (in Czech.). *Cas. lek. cesk.*, 31 Jan. 1957, **96**(5), 140-146 (includes treatment with reserpine).

SPECKMANN, I. Serpasil in medicamentous hypertension therapy (in German). *Therap. d.Gegenw.*, 1955, **94**(2), 44-9.

SPERLING, F. Screening new compounds: Criteria for ataractic effects. *Fed. Proc.*, Mar. 1957, **16**, 337 (abstract: includes reserpine).

SPROGIS, G.R. et al. Comparative study on thorazine and serpasil in the mental defective. *Amer. J. ment. Defic.*, Apr. 1957, **61**(4), 737-742.

SPROGIS, G. R. Reserpine treatment of psychosis following a hyperectomy. *Amer. Pratit.*, Feb. 1958, **9**(2), 253-255.

SPUHLER, O. and SCHEU, H. Studies of the effect of serpasil and ecolid on blood circulation in arterial hypertension (in German). *Cardiologia*, 1957, **31**(1), 51-78.

SRIVASTAVA, S.K. et al. Studies on the metabolism of reserpine. Pt.III. 3-Epireserpine. *J. sci. industr. Res.*, Apr. 1957, **16C**(4), 73-74.

STAPPENBEK, G. Treatment of hypertension with *R. serpentina* (in German). *Dtsch. med. J.* (Berlin), 15 Jan. 1954, **5**(1/2), 31-33.

STECK, H. Extrapyramidal and diencephalic syndrome in the course of largactil and serpasil treatment (in French). *Ann. med. psychol.*(Paris), Dec. 1954, **2**(5), 737-44.

STECK, H. Extrapyramidal syndrome in chlorpromazine and serpasil therapy, clinical symptomatology and therapeutic role (in French). *Encephale*, 1956, **45**(4), 1083-1089.

STEGER, R. Clinical investigations with manganocholine forte (in German). *Schweiz. med. Wschr.*, 1957, **87**, 195-198 (includes reserpine).

STEIN, L. Reserpine and the learning of fear. *Science*, 1956, **124**(3231), 1082-1083.

STEIN, E. Clinical actions of the *Rauwolfia* alkaloids. *Plant. med.*, 15 Dec. 1957, **5** (56), 165-182.

STEINBERG, S.M. Serpasil treatment of nervous and mental disorders (in Russian). *Soviet. med.* (Moscow), Feb. 1957, **21**(2), 88-92. (A review of foreign literature).

STEPHEN, C.R. et al. Preoperative, and postoperative sedation with reserpine. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 236-49.

STERNBERG, U. et al. Evaluation of chlorpromazine and reserpine therapy with follow-up study. *J. clin. exp. Psychopath.*, July-Sept. 1957, **18**(3), 258-268.

STETTBACHER, A. Ambulant therapy of hypertension (in German). *Praxis*, 17 Feb. 1955, **44**(7), 138-9.

STIRSKA, J. and STEPAN, J. Reserpine poisoning in small children (in German). *Dtsch. med. Wschr.*, 1957, **82**, 1963-1965.

STOLL, W.A. Conference on reserpine in the treatment of neuropsychiatric, neurological and related clinical problems, New York, 3-4 Feb, 1955 (German summary in) *Schweiz. med. Wschr.*, 7 May 1955, **85** (19), 439-40).

STONEHILL, S. A comparative study of the treatment of essential hypertension; the effect of *Rauwolfia* and *Rauwolfia* compound (*Rauwolfia*, mannitol hexanitrate, and rutin). *Arch. intern. Med.*, Feb. 1956, **97** (2), 189-93.

STREHL, W. Experiences with reserpine in the treatment of agitated and overactive children and adolescents (in German). *Nervenartz*, 20 June 1958, **29**(6), 271-273.

STREITENBERG, H. Influence of rivasin on intraocular pressure (in German). *Klin Mbl. Augenheilk.*, 1955, **126** (3), 335-6.

STRUSS, E. and HILLER, J. Reserpine. *Med. klin.*, 1954, **27**, 1073.

STUPPY, L.J. and TOBER, J.N. Treatment of hypertension with reserpine (Serpasil) alone and in combination with hydralazine (apresoline). *Angiology*, June 1955, **6** (3), 253-9.

STURKIE, P.D. et al. Effects of reserpine on the fowl. *Amer. J. Physiol.*, 1958, **194**, 184-186.

STURTEVANT, F.M. Prolongation of hexobarbital-hypnosis in mice by iproniazid, serotonin and reserpine. *Naturwissenschaften*, 1956, **43**, 67.

STURTEVANT, F.M. Response of metacorticoid hypertension to bistrium, apresoline, veriloid and serpentina. *Proc. Soc. exp. Biol* (N.Y.), Aug.-Sept. 1953, **83**(4), 101-2.

STURTEVANT, F.M. and DRILL, V.A. Influence of ataraxies on the mescalline response of cats injected in lateral ventricle of the brain. *Fed. Proc.*, Mar. 1956, **15**, 489-490 (abstract).

STURTEVANT, F.M. and DRILL, V.A. Tranquillizing drugs and morphine mania in cats. *Nature*, 15 June 1957, **179** (4572), 1253 (includes reserpine).

STURUP, H. Reserpine (Serpasil) alone and combined with appresoline, in ambulant therapy of hypertension (in Danish). *Ugeskr. Laeg.*, 5 May 1955, **117** (18), 564-8.

STURUP, H. and GRUNER, A. Combined drug treatment of grave nonmalignant hypertension (in Danish). *Ugeskr. Laeg.*, 3 Oct. 1957, **119**, 1298-1303.

SUCKLE, E. Comparison of *Rauwolfia* drugs in treatment of hypertension. *Geriatrics*, Nov. 1956, **11**(11), 509-513.

Summary of tranquilizing drugs, *Drug Trade News*, 28 Jan. 1957 (incl. ref. to *Rauwolfia* alkaloids. Since most of these news items are summaries of papers that appeared elsewhere, this is actually a cumulative index to abstracts on tranquillizers).

SUPNIEWSKA, H. *Rauwolfias* and their importance in therapeutics (in Polish). *Farm Polska*, Apr. 1955, **11** (4), 73-9.

SWENSON, W.M. et al. Behavioural evaluation of chronic mental patients treated with reserpine. *Arch. Neurol. Psychiat.* (Chicago), July 1956, **76** (1), 60-4.

SZEKELY, A. et al. ECG examinations with reserpine in differential diagnosis of organic and functional cardiac disorders (in Hungarian). *Orv. Hetil.*, 23 June 1957, **98** (25), 674-676.

SZEKELY, A. et al. Electrocardiographic investigation with reserpine (Serpasil) of the separation of structural preparation in so-called cough bronchogram (in German). *Zschr. arztl. Fortbild.*, 1 Apr. 1958, **52**(7), 276-278.

SZENDEY, G.L. Note on the determination of reserpine in pharmaceutical preparations (in German). *Arch. Pharm.* (Berlin), 1958, **291** (5), 215-218.

TABBUT, H.M. Some clinical uses for *R. serpentina*. *J. Amer. vet. med. Ass.*, 1 Feb. 1956, **128**(3), 156 (Reserpine in noise phobia in dogs).

TABOADA-MILIAS, C. Treatment of arterial hypertension in pregnancy (in Spanish). *Rev. cubana Cardiol.*, Apr.- June 1956, **17**(2), 85-108 (includes reserpine).

TABOADA-MILIAS, C. and JAY PEREZ, L.F. *Rauwolfia* and veratrum in the treatment of arterial hypertension; preliminary report on their combined use (in Spanish). *Arch. Hospi. univ.* (Habana), July-Aug. 1954, **6**(4), 341-50.

TAESCHLER, M. and CERLETTI, A. Some observations on the interaction of reserpine and lysergic acid diethylamide (L.S.D.). *J. Pharmacol.*, 1957, **120**, 179-183.

TAKAGI, HIROSHI, et al. The effect of LSD and reserpine on the central nervous system of the cat. *Japanese J. Pharmacol.*, 1956, **7**, 119-134.

TAKETOMO, Y. et al. Studies on the mechanism of reserpine epinephrine release and hyperglycemia. *J. Pharmacol.*, Jan. 1957, **119**(2), 118 (abstract).

TALAS, M. et al. Treatment of gestosis by new hypertensive drugs (in Czech.). *Cas. lek. cesk.*, 18 Jan. 1957, **96**(3), 83-86.

TALBOT, M.W. The use of reserpine in irritable and hypertonic infants. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61** (1), 188-97.

TANCK, R.H. Psychologic changes induced by reserpine therapy on a group of severely disturbed psychotics. *J. Nerv. ment. Dis.*, Apr. 1958, **126**(4), 353-359.

TARDOS, L. and JOBBAGYI, Z. The effect of reserpine on the action of analgesics (in German). *Acta physiol. hung.*, 1958, **13**(2), 171-178.

TARKA, S. Serpasil in hypertension (in Polish). *Polskie arch. med. Wewn.*, 1957, **27**(4), 509-517.

TASHER, D.C. and CHERMAK, M.W. The use of reserpine in shock-reversible patients and shock-resistant patients. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 108-16.

TAUBER, H. and GARSON, W. Effect of cortisone properdin and reserpine on neisseria, gonorrhoea endotoxin activity. *Proc. Soc. exp. Biol. Med.* (N.Y.), 1958, **97**(4), 886-887.

TEANI, H. Reserpine in neuro-psychiatry (in Italian). *Riv. sper. Freniat.*, 1 Aug. 1956, **80** (3), 615-637.

TERAN, A. Combined use of serpasil and apresoline in hypertension (in Spanish). *Dia. med.*, 25 Feb. 1957, **29**(8), 202-203.

TERMAN, L.A. Alseroxylon (Rauwiloid) therapy in disturbed elderly patients. *Illinois. med. J.*, Feb. 1957, **111**(2), 67-69.

TERRY, L.L. The mechanism of action of the *Rauwolfia* drugs. *Med. Ann. D.C.*, Apr. 1957, **26**(4), 167-170.

TERZIAN, H. Experimental study of the action of reserpine (Serpasil) on the central nervous structures (in French). *Encephale*, 1956, **45**(4), 835-842.

TESSIER, R. et al. Serpasil in tuberculosis (in French). *J. med. Bordeaux*, 1956, **133**(1), 26-30.

THIELE, F.H. Analytical studies of circulation concerning the effect of a combination of *Rauwolfia* alkaloids in essential hypertension (in German). *Med. Mschr.* (Stuttgart), Oct. 1957, **11**(10), 645-648.

THOMSEN, P. and ORTUZAR, R. Prolonged treatment of severe arterial hypertension with combined pentolinium tartrate, hydralazine and *Rauwolfia* (in Spanish). *Arch. Inst. cardiol.* (Mexico), May-June 1957, **27**(3), 333-344.

THORN, N. Combined drugs in therapy of arterial hypertension; a brief review. *Meddl. Sund. Vgeskrift for Laeger* (Kobenhavn), 15 Apr. 1954, **116**(15), 573-4.

THORN, N. *Rauwolfia serpentina* alkaloids in therapy of arterial hypertension (in Swedish). *Nord. med.*, 17 Dec. 1953, **50**(51), 1741.

THUILLIER, J. *Rauwolfia serpentina*. *Concours med.*, 11 Sept. 1954, **76**(37), 3353-4.

THUILLIER, J. and MOUILLE, P. Effect of total extract of *R. serpentina* on the isolated intestine of the guinea pig (in French). *C. R. Soc. Biol.* (Paris), May 1954, **148** (9-10), 825-7.

TICE, L.F. A new approach in neuropsychology? (Editoral). *Amer. J. Pharm.*, 1954, **126**(10), 324-25. (reference to tranquillizing effect of *Rauwolfia*).

TIMBERLAKE, W.H. et al. The effect of reserpine in 200 mentally retarded children. *Amer. J. ment. Defic.*, July 1957, **62**(1), 61-66.

TODRICK, A. et al. Effect of reserpine in therapeutic dosage on excretion of 5-hydroxyindoleacetic acid. *Brit. med. J.*, 1 Mar. 1958, No. 5069, 496-499.

TOJA, G. Hypotensive action of *R. serpentina* alkaloid (reserpine) (in Italian). *Minerva med.* (Torino), 8 Dec. 1954, **45**(98), 1547-9.

To lower the blood pressure; reserpine. *Newsweek*, 22, Feb. 1954, **43**, 102.

Tools for mental therapy: Reserpine and chlorpromazine are giving dramatic results. *Chem. Week*, 28 May 1955, **76**, 66.

TOULOUSE, J. New treatment for hypertension (in French). *Vie med.*, Apr. 1955, **36**(4), 522-6.

TOURNEY, G. et al. The use of reserpine in an acute psychiatric treatment setting. *Arch. Neurol. Psychiat.*, (Chicago) Sept. 1955, **74**(3), 325-8.

TRAMONTANO, A. Results and considerations on sedative treatment with *Rauwolfia serpentina* alkaloid (reserpine) and antidystonic with sodium glycerophosphates in menopausal disorders (in Italian). *Riv. Ostet.* (Milano), Dec. 1956, **38** (12), 1024-1027.

TRAPOLD, J.H. et al. Cardiovascular and respiratory effects of serpasil, a new crystalline alkaloid from *R. serpentina*, Benth. in the dog. *J. Pharmacol.*, 1954, **110**(2), 205-14.

TRINITY, G.J. Management of the depressed patient. *Med. Times* (Great Neck), 1954, **82**(10), 753-7.

TRIPOD, J. and MEIER, R. Determination and pharmacodynamic classification of the peripheral vascular action of apresoline, of nepresol and of serpasil (in French). *Arch. int. Pharmacodyn.*, 1 Sept. 1954, **99**(1), 104-25.

TRIPOD, J. and MEIER, R. Effect of serpasil (reserpine), a new alkaloid from *R. serpentina*, Benth. on isolated circulatory organs (in German). *Acrh. int. Pharmacodyn.*, 1954, **97**, 215-66.

TRIPOD, J. et al. Characterization of central effects of serpasil (reserpine, a new alkaloid of *R. serpentina*, Benth.) and of their antagonistic reactions (in French). *Arch. int. Pharmacodyn.*, 1954, **96**, 406-25.

TRUTCHEL, W. Treatment of thyrotoxicosis or of hyperthyroidism with potassium perchlorate and reserpine (in German). *Munch. med. Wschr.*, 13 Sept. 1957, **99**, 1337-1339.

TSIEN, W.H. et al. Uptake of reserpine-C^{14} by various areas of the cat brain. *Fed. Proc.*, Mar. 1957, 493 (abstract).

TUCHEK, S. *Rauwolfia serpentina*, Benth. alkaloids in clinical practice; a review of literature (in Russian). *Klin. med. Mosk.*, Mar. 1957, **35**(3), 38-45.

TUCHMAN, H. and CRUMPTON, C.W. A comparison of *R. serpentina* compounds, crude root, alseroxylon derivatives, and single alkaloids, in the treatment of hypertension. *Amer. Heart J.*, 1955, **49**(5), 742-50.

TUCHMAN, H. et al. A clinical study of the effects of intravenous reserpine (Serpasil) in hypertensive patients. *Amer. Heart J.*, Sept. 1954, **48** (3), 449-54.

TUCHMANN-DUPLESSIS, H. Effect of reserpine on the endocrine glands (in French). *Pr. Med.*, 25 Dec. 1956, **64**(94), 2189-2192.

TUCHMANN-DUPLESSIS, H. and GERSHON, R. Influence of lactogenic hormone on hormonal imbalance in the pregnant rat treated with reserpine. *C.R. Acad. Sci.* (Paris), 1957, **245**, 738-740.

TUCHMANN-DUPLESSIS, H. and MERCIER-PARAOT, L. Action of reserpine on the mammary gland of the male and female rat (in French). *C.R.Soc. Biol.*(Paris), 1957, **151**, 656-658.

TUCHMANN-DUPLESSIS, H. and MERCIER-PARAOT, L. Repercussion of reserpine on gestation in rats (in French). *C.R. Soc. Acad.* (Paris), 23 July 1956, **243**(4), 410-412.

TUCHMANN-DUPLESSIS, H. et al. Pregnancy disorders in the rat, induced by reserpine and compensatory hormone treatment trials (in French). *J. Physiol.* (Paris), Nov. 1957, **49** (5), 1007-1019.

TULCZYNSKI, M. and MIEDSZIANOWSKI. A. Assay with serpasil in Basedow's disease (in Polish). *Polski. tygod. lek.*, 16 Sept. 1957, **12**(38), 1452-1453.

TURNER, W.J. and CARL, A. Effect of reserpine on the melanophores of fish. *Science*, 17 June 1955, **121**, 877-8.

TURNER, W.J. et al. Chemotherapeutic trials in psychosis. II. Design and conduct of a trial of raunormine versus reserpine and phenobarbital in chronic schizophrenia. *Arch. Neurol. Psychiat.* (Chicago), May 1958, **79** (5), 597-602.

TUTEUR, W. Effect of chlorpromazine and reserpine on budgets of mental hospitals. *Amer. J. Psychiat.*, Jan. 1957, **113** (7), 657-659.

TUTEUR, W. et al. Treatment of regressed schizophrenics with chlorpromazine, reserpine and a combination of both drugs. *Dis. nerv. Syst.*, Feb. 1957, **18**(2), 100-105.

TYHURST, J.S. and RICHMAN, A. Clinical experience with psychiatric patients on reserpine—preliminary impressions. *J. Canad. med. Ass.*, 15 Mar. 1955, **72**(6), 458-9.

ULBILLUZ, R. et al. Effects of reserpine on the digestive apparatus. I. On gastric secretion. II. On biliary secretion III. On bromsulphalein retention (in Spanish). *Ann. Fac. med. Lima*, 1956, **39**(4), 1301-1317.

VACHON, A. and TOMASI, B. Development of duodenal ulcer during treatment with reserpine (in French). *Lyon. med.*, 7 July 1957, **89** (27), 9-11.

VACHON, A. and TOMASI, B. Pathogenesis of duodenal ulcer caused by reserpine (in French). *Arch. Mal. Appar. dig.* (Paris), Sept. 1957, **46**(9), 868-870.

VAHIA, N.S. *Rauwolfia serpentina* in physiological medicine. *Indian. J. med. Sci.*, 1956, **10**, 692-695.

VAKIL, R.J. Cardiovascular and other applications of tranquillizing drugs. *Indian J. Pharm.*, 1958, **20** (2), 49-51. (*Rauwolfia* and reserpine, pp. 49-50).

VAKIL, R.J. Clinical applications and uses of *Rauwolfia* preparations. *Indian J. Pharm.*, 1956, **18**(7), 306-8.

VAKIL, R.J. Clinical observations in *R. serpentina* therapy (in German). *Medizinische*, 1 Jan. 1955, No. 1, 47-8.

VAKIL, R.J. Clinical trial of *Rauwolfia serpentina* in essential hypertension. *Brit. Heart J.*, Oct. 1949, **11**, 353-55.

VAKIL, R.J. Hypotensive action of another *R. serpentina* alkaloid: a clinical report. *J. Indian med. Ass.*, 1953, **23**(3), 97-103.

VAKIL, R.J. *Rauwolfia serpentina* in the treatment of high blood pressure. *Lancet*, 9 Oct. 1954, **267**, 726-7.

VAKIL, R.J. *Rauwolfia serpentina* in the treatment of high blood pressure, a review of the literature. *Circulation*, Aug. 1955, **12**(2), 220-9.

VAKIL, R.J. Some thoughts on *Rauwolfia* and cardiovascular disease. *Curr. med. Pract.*, 1958, **2**, 4-6.

VALCOURT, A.J. 8-Hydroxyindoleacetic acid excretion in man. *Fed. Proc.*, Mar. 1957, **16**, 130 (abstract: includes reserpine).

VALDECASAS, F.G. et al. Pharmacology of *R. serpentina* (in French). *Therapie*, 1954, **9**(4), 496-511.

VALDES RUIZ, M. and ALMELA GUILLEN, J. Reserpine in tachycardias (in Spanish). *Med. esp.* (Valencia), Nov. 1955, **34**(200), 438-43.

VAN DONGEN. Action of some drugs on fibrillation of the heart (Rauwolfin). *Arch. int. Pharmacodyn.*, 1936, **53**, 80.

VANNOTTI, A. Reserpine and thyroid function (in German). *Schweiz. med. Wschr.*, 7 Apr. 1957, **87**(14), 412-413.

VERETIANOV, I.I. Treatment of hypertension with a drug extracted from *Rauwolfia* root (in Russian). *Klin. med. Mosk.*, May 1957, **35** (5), 65-70.

VERGANI, O. and ALDEGHI, E. Use of total alkaloids of *Rauwolfia serpentina* in child neuropsychiatry (in Italian). *Minerva pediat.* (Torino), 29 Sept. 1956, **8**(39), 1161-1165.

VERGIN, F. The use of *Rauwolfia serpentina* in high - pressure diseases (in German). *Z. Naturhk.*, 1954, No. 11, 168.

VERLEY-LECLERC, R. *Rauwolfia serpentina*. *Acta Phytother.*, 1955, **2**(5), 4-13.

VERMEULEN, A. and LEUSEN, I. Effect of reserpine on urinary gonadotropin excretion in in postmenopausal or castrated women. *Ann. Endocr.* (Paris), Sept.-Oct. 1957, **18**(5), 803-807.

VERNE, J. et al. Comparative study of the effect exercised by reserpine and hypophysectomy on the testes and seminal vesicles in the rat (in French). *Ann. Endocr.* (Paris), Nov.-Dec. 1957, **18**(6), 952-958.

VIAL, S.U. et al. Reserpine and apresoline on renal response to renin and on antidiuretic potency of blood of normal rats. *J. appl. Physiol.*, 1957, **11**, 227-230.

VIDA, F. Indian *Rauwolfia serpentina* (in German). *Medizinische Welt.*, 13 Sept. 1952, 1157-59.

VINCENT, D. and FROMMEL, E. Effects of meprobamate plus reserpine on blood pressure and heart rate in the dog (in French). *Med. Hyg.* (Geneva), 1957, **15**, 615.

VINCENT, D. and SEGONZAC, G. Comparative anti-acetylcholinic and antihistaminic actions of reserpine and serpentine on the isolated guinea pig ileum (in French). *C.R. Soc. Biol.* (Paris), 1957, **151**(7), 1434-1437.

VINCENT, P. et al. Reserpine and serpentine on cholinesterases (in French). *C.R. Soc. Biol.* (Paris), 1956, **150**, 1462-1464.

VISCONTI, M.F. and ABBATI, G. Use of total *R. serpentina* alkaloids in senile hypertension of women; clinical and electrocardiographic aspects (in Italian). *Giorn. Clin. med.* (Parma), 1955, **36**(10), 1413-48.

VIVIEN, P. Neurological and psychological effects of *Rauwolfia* and its alkaloids (in French). *Ann. med. Psychol.*, Feb. 1955, **113**, 217-26.

VOELKEL, A. Sedaraupin therapy of mental patients (in German). *Medizinische*, 5 Feb. 1955, No. 6, 227-8.

VOGT, W. Clinical comparison of the effects of largactil and serpasil (in German). *Schweiz. Arch. Neurol. Psychiat.*, 1956, **77**(1-2), 330-336.

VOLANSCHI., M. et al. Pharmacodynamic investigations on higher nervous activity. II. Action of reserpine on higher nervous activity. *Rev. Fiziol. Norm. Patol.*, 1957, **4**(5), 427-439.

VOLCHKOV, B.P. Reserpine in therapy of hypertension (in Russian). *Klin. med. Mosk.*, Mar. 1957, **35**(3), 151-152.

VOLFOVA, V. and REISZ, O. Note on therapy of hypertension with reserpine (Serpasil). (in Czech.). *Cas. Lek. Cesk.*, 13 May 1955, **94**(20), 527-33.

VOFOVA, V. and REISZ, O. Serpasil in therapy of hypertension and its effect on the orthostatic test and cold pressor test (in German). *Praxis*, 12 Apr. 1956, **45**(15), 339-43.

VORISEK, V. Reserpine treatment of Huntington's chorea and other extrapyramidal syndromes (in Czech.). *Ces. neurol.*, Mar. 1958, **21**(2), 99-105.

VOSKIAN, J. et al. Hemodynamic effects and clinical application of a mixture of veratrum and *Rauwolfia* alkaloids. *Surg. Gynec. Obstet.*, 1956, **102**(1), 37-44.

WAALKES, T.P. and WEISSBACH, H. In vivo release of histamine from rabbit blood by reserpine. *Proc. Soc. exp. Biol.* (N.Y.), 1956, **93**, 394-396.

WALANDER, A. and RUBENSOHN, G. Reserpine therapy of tinnitus aurium (in German). *Pract. oto-rhino-laryng.*, Jan. 1957, **19**(1), 55-59.

WALDRON, J.M. et al. The treatment of diastolic hypertension with a fixed combination of hypotensive drugs. *Amer. J. med. Sci.*, Nov. 1955, **230**(5), 551-7.

WALLACE, C. Treatment of hypertension ; hypotensive drugs and mental changes. *Lancet*, 16 July 1955, **269**, 116-7.

WALSEN, O. Clinical experiences in the treatment of hypertension with Raupina (in German). *Therap. Gegenw.*, 1954, **11**, 420.

WALTHER-BUEH, H. The neuroplegic principle in pharmacopsychiatric considerations (in German). *Mschr. chiat. Neurol.* (Basel), Jan.-Mar. 1955, **129**(1-3), 286-96.

WALTHER-BUEH, H. Serpasil therapy for neuropsychiatric conditions (in German). *Praxis.*, 9 Aug. 1956, **45**(32), 733-736.

WARD, JOHN and HAZLETON, L.W. Studies on Rauserfia; a *Rauwolfia* derivative. *J. Amer. pharm. Ass.*, (*Sci. Ed.*), 1956, **45**(5), 305-9.

WARDEN, C.J.H. and BOSE, C.L. *Rauwolfia serpentina*. Yearbook of Pharmacy, 1893. London, 1893. (Physiological study of the first alkaloid separated, p. 128).

WARE, L. M. and PROUT, C.T. A controlled study of reserpine in the treatment of mental illness. *Bull. N.Y. Acad. Med.*, Sept. 1956, **32**(9),643-650.

WASICKY, RICHARD. Biological analysis of the action of re serpine, of the subst ances or drugs, also of excitatory action of certain substances on the mouse (in Portuguese). *Trib. Farm.*, 1956, **24**(11), 161-66.

WATKINS, C. The use of reserpine in cerebral palsy. *Sth. med. J.*, Dec. 1956, **49**(12), 1488-1494.

WATSCHINGER, B. *Rauwolfia serpentina* (in German). *Wien Z. inn. Med.*, June 1953, **34**(6), 273-82.

WATT, D.B. Reserpine and chlorpromazine in the treatment of chronic schizophrenics. *Encephale*, 1956, **45**(4), 661-662.

WEBB, L.J. Guide to the medicinal and poisonous plants of Queensland. (Commonwealth of Australia C.S.I.R. Bull. No 232). Melbourne, 1948. (*R. canescens*, p. 19).

WEBER, E. A *Rauwolfia* alkaloid in psychiatry; similarity of its effects to those of chlorpromazine (in German). *Schweiz. med. Wschr.*, 21 Aug. 1954, **84**(34), 968-70.

WEBSTER, M.B. Drug therapy in hypertension. *J. Lancet*, Sept. 1954, **74**(9), 333-6.

WEFRING, K.W. Hypotensive drugs in therapy of pregnancy toxemias (in Norwegian). *Tidsskr. norske Laegeforen* (Oslo), 15 Oct. 1955, **75** (20), 713-5.

WEIL-MALHERBE, H. and BONE, A.D. Effect of reserpine on the intracellular distribution of catecholamines in the brain stem of the rabbit (Lett.). *Nature*, 24 May 1958, **181** (4621). 1474-75.

WEISHAUS, J. Use of reserpine (Serpasil) in psychotic patients, a preliminary report. *Dis. nerv. Syst.*, 1955, **16**(11), 347-50.

WEISKRANTZ, L. and WILSON, W.A. Effect of reserpine on learning and performance. *Science*, 22, June 1956, **123**, 1116-18.

WEISKRANTZ, L. and WILSON, W.A. The effectl of reserpine on emotional behaviour ; normas and brain-operated monkeys. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 36-55.

WEISS, EDWARD and ENGLISH, O.S. Psychosomatic medicine. A clinical study of psychophysiologic reactions. 3rd ed. Philadelphia, London, Saunders. 1957. xix 557 pp. (*Rauwolfia* alkaloids in psychotherapy, p. 152).

WELLS, H. et al. Inhibitory effect of reserpine in adrenocorticotrophic hormone secretion in response to stressful stimuli. *Endocrinology*, 1956, **59**, 571-579.

WELLS, R.E. Use of reserpine (Serpasil) in the management of chronic alcoholism. *J. Amer. med. Ass.*, 9 Feb. 1957, 426-429.

WERNER, G. Effect of *Rauwolfia serpentina* (in German). *Arzneimittel-Forschung*, 1954, **4**(1), 40-1.

WERNER, G. *Rauwolfia serpentina*. *Bull. Calcutta Sch. of trop. Med.*, 1953, **1**(1), 9.

WEST, W.O. Perforation and hemorrhage from duodenal ulcer during the administration of *Rauwolfia serpentina*. Report of five cases. *Ann. intern. Med.*, May 1958, **48**(5), 1933-1039.

WESTCOTT, G. Serpasil as an adjunct to brief intensive psychotherapy with two psychotic patients. *J. nerv. ment. Dis.*, 1956, **123** (1), 53-6.

WESTERMANN, E. et al. Effect of the inhibition of monoaminoxidase in serotonin action; relation to the mechanism of reserpine action (in German). *Arch. exp. Path. Pharmak.*, 1957, **232**(1), 282-284.

WHITMAN, R.M. et al. Rauwiloid and preoperative anxiety; a double blind placebo study. *Q. Bull. Northw. Univ. med. School.*, Summer 1956, **30** (2), 170-174.

WILCZOWSKY, E. Chlorpromazine and reserpine therapy of mental disorders (in Polish). *Polski. tygod. lek.*, 19 Aug. 1957, **12**(34), 1301-1302.

WILCZKOWSKY, E. Treatment of mental disorders with chlorpromazine and reserpine (in Czech.). *Cesk. psychiat.*, Sept. 1957, **53**(4), 217-219.

WILDE, W. Treatment of arteriosclerotic hypertension with an organic iodine compound and combined prepartion of organic iodine compound and reserpine (in German). *Ther. d. Gegenw.*, Feb. 1957, **96**(2), 57-60.

WILKINS, R.W. Clinical usage of *Rauwolfia* alkaloids, including reserpine (Serpasil). *Ann N.Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 36-44.

WILKINS R.W. Combinations of drugs in the treatment of essential hypertension (pure reserpine-serpasil). *Mississippi Doctor*, 5 Apr. 1953, 359.

WILKINS, R.W. Current therapeutics. LXXIX. *Rauwolfia serpentina*. *Practitioner*, July 1954, **173**, 84-9.

WILKINS, R.W. New drug therapies in arterial hypertension. *Ann. intern. Med.*, 1952, **37**, 1144.

WILKINS, R.W. *Rauwolfia* in the treatment of essential hypertension. *Amer. J. Med.*, Nov. 1954, 703-11.

WILKINS, R. W. Use of *R. serpentina* in hypertensive patients (*Rauwolfia* extracts). *NewEngl. J. Med.*, 1953, **248**, 48.

WILKINS, R.W. et al. Preliminary observation on *R. serpentina* in hypertensive patients. *Proc. New Engl. Cardiovasc. Soc.*, 1951, **34**.

WILKINS, R.W. et al. Reserpine in the treatment of hypertension. A note on the relative dosage and effects. *New Engl. J. Med.*, 1954, **250**, 477.

WILSON, B. N. and WIMBERLEY, N. A. Production of premature ventricular contractions by *Rauwolfia*. *J. Amed. med. Ass.*, 3 Dec. 1955, **159**(14), 1363-4.

WINDLE, W.F. and CAMMERMEYER, J. Functional observations on chronically reserpinized monkeys. *Science*, 1958, **127**(3313), 1503.

WINDLE, W.F. et al. Effects of reserpine in animals, especially primates. *Trans. Amer. Neurol. Ass.*, 1956, 81st meeting, 69-71.

WING, L. The use of reserpine in chronic psychotic patients; a controlled trial. *J. ment. Sic.*, July 1956, **102**(428), 530-541.

WINKELSTEIN, A. Treatment of gastro-intestinal diseases with an anti-cholinergic and tranquilizers. *Amer. J. Gastroenter.*, July 1958, **30**(1), 68-72 (includes reserpine).

WINSOR, T. Human pharmacology of reserpine. *Ann. N.Y. Acad. Sci.*, 30 Apr. 1954, **59**(1), 61-81.

WINSOR, T. Reserpine and the alseroxylon alkaloids of *Rauwolfia serpentina* in hypertension. *Ariz. med.*, 1953, **10**(11), 419-25.

WINTON, S.S. Therapeutic value and limitations of an ataractic drug (rescinnamine). *Int. Rec. Med.*, Dec. 1957, **170** (12), 665-671.

WIRTH, WOLFGANG. The pharmacology of recently introduced centrally effective substances (in German). *Dtsch. med. Wschr.*, Oct. 1957, **82**, 1745-1749 (includes reserpine).

WITTLINGER, G. Management of hypertension (in German). *Ther. d. Gregenw.*, Dec. 1956, **95** (12), 451-454 (includes treatment with reserpine).

WODRASKA, T.W. et al. Combined retalin and Serpasil therapy in chronic psychosis. *Dis. nerv. Syst.*, Mar. 1958, **19**(3), 122-136.

WOFFORD, J.D. and CUMMINS, A.J. Hemorrhage from duodenal ulcer during the administration of reserpine. *New Engl. J. Med.*, 20 Dec. 1956, **255**(25), 1193-1194.

WOLFRAM, S. Treatment of skin with serpasil; preliminary report (in German). *Hautarzt* (Berlin), 1956, **7**(4), 183-84.

WOLFSON, I.N. Clinical experience with serpasil and thorazine in treatment of disturbed behaviour of mentally retarded. *Amer. J. ment. Defic.*, Sept. 1957, **62**(2), 276-283.

WOLKERSTORFER, H. Problems of hypertension and combination therapy (in German). *Wien. med. Wschr.*, 30 Nov. 1957, **107**(48), 992-995.

WUNDERLICH, H. Colorimetric determination of *Rauwolfia* alkaloids in pharmaceutical preparations with ammonium reineckate (in German). *Pharm. Zentralb.*, 1957, **96**(2), 68-71.

YABLONSKI, M.D. et al. Some cardiovascular effect of reserpine. *Amer. J. med. Sci.*, June 1958, **235**(6), 639-643.

YADA, HIROSHI. The action of *Rauwolfia serpentina* alkaloid on the blood vessel. *Folia Pharmacol. Japonica*, 20 Nov. 1957, **53**(6), 1075-1085.

YAMAGUCHI, TAKASHI et al. Pharmacological and clinical reviews on *Rauwolfia* alkaloids. *Shinyaku to Rinsho*, 1955, **4**, 311-317.

YAMAMOTO, TAKAYA and YAMANAKA, MANABU. Pharmacological and clinical reviews on *Rauwolfia* alkaloids. *Shinyaku to Rinsho*, 1955, **4**, 175-177.

ZAFIR, M. The combination reserpine - urethane (in German). *Folia pharm.* (Istanbul), 1957, **4** (1), 334-335.

ZAHN, K. Effect of serpasil on retinal circulation. VII. Experimental pharmacological studies (in Czech.). *Csl. Oftal.*, June 1956, **12**(3), 174-7.

ZAKON, S. et al. The therapeutic effectiveness of raudixin in psoriasis; an impression type study. *Q. Bull. Northw. Univ. med. School*, 1958, **32**(2), 131-134.

ZAMBIANGH , A. Echo of the symposium of Milan on reserpine and chlorpromazine in psychiatry (in French). *Encephale*, 1956, **45**(4), 1071-1075.

ZAMBONI, P. The capillary resistance in rats treated with reserpine. *Arch. int. Pharmcodyn.*, 1 Dec. 1957, **113**(1-2), 203-208.

ZBINDEN, G. et al. Inhibition by isoprophylisonicotinic acid hydrazide (Marsidid) of the liberation of 5-hydroxytryptamine (HT) by reserpine from the enterochromaffin system (in German). *Klin. Wschr.*, 1957, **35**, 565-567.

ZBINDEN, G. et al. Local differences of reserpine action on enterochromaffin cells and 5-hydroxytryptamine content in the gastrointestinal tract (in German). *Schweiz. med. Wschr.*, 1957, **87**, 629-631.

ZELLER, W.W. et al. Use of chlorpromazine and reserpine in the treatment of emotional disorders. *J. Amer. med. Ass.*, 21 Jan. 1956, **160**(3), 179-84.

ZERVOPOULUS, G. Experiments with ambulatory serpasil treatment in neuro-psychiatric patients (in German). *Praxis*, 1958, **47**(31), 742.

ZIMMERMAN, F.T. and BURGEMEISTER, B.B. The effect of reserpine on the behaviour problems of children. *N.Y. St. J. Med.*, 1 Oct. 1957, **57** (19), 3132-3140.

ZIMMERMAN, F.T. and BURGEMEISTER, B.B. Preliminary report upon the effect of reserpine on epilepsy and behaviour problems in children. *Ann. N.Y. Acad. Sci.*, 15 Apr. 1955, **61**(1), 215-21.

ZINK, O. Disorders of circulatory regulation in dysautonomia and their treatment (in Germen). *Medizinische.*, 15 June 1957, No. 24, 913-915 (includes treatment with reserpine).

ZINNITZ, FRITZ. Influence of the active substances of *Rauwolfia serpentina* on the neurovegetative regulation of heart and circulatory activity. *Med. Mschr.*, 1957, **11**, 284-290.

ZINNITZ, F. and HAMMER, O. Hypertension and *Rauwolfia* substances (in German). *Med. Klin.*, 30 Aug. 1957, **52**(35), 1528-1531.

ZIPF, K. Pharmacology of *Rauwolfia* alkaloids. *Arzneimittel Forschung*, 1957, **7**, 475-477 (incl. ajmaline).

ZLOTLOW, M. and PAGANINI, A.E. Fatalities in patients receiving chlorpromazine and reserpine during 1956-1957 at Pilgrim State Hospital. *Amer. J. Psychiat.*, Aug. 1958, **115**(2), 154-156.

ZURLO, A. and BARDELLI, S. Effect of reserpine on eosinopenia caused by adrenalin and ACTH (in Italian). *Rif. med.*, 23 Feb. 1957, **71**(8), 197-198.

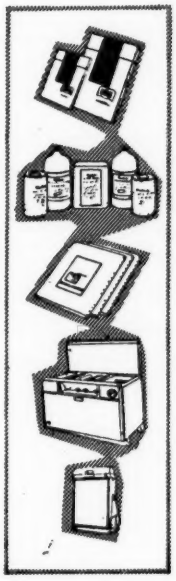
NEVER A DOUBTFUL SHADOW

with radiographs made on 'Kodak' X-ray Film . . . processed in 'Kodak' Chemicals

You can *depend* on the consistent high quality of 'Kodak Blue Brand X-ray Film to give you radiographs rich in detail, correct in contrast—to help *you* diagnose correctly, confidently. And for the most satisfying results, process in reliable 'Kodak' Chemicals... top quality products of continuous research.

'Kodak' X-ray Film and Chemicals are carefully quality controlled... are made to work together to produce radiographs of maximum diagnostic quality. *Stored under correctly controlled conditions of temperature and humidity, 'Kodak' X-ray Film comes to you in perfect condition.*

Kodak Limited
(Incorporated in England with Limited Liability)
Lahore — Karachi — Chittagong



Range of 'Kodak' X-ray materials and equipment

'Kodak' Blue Brand X-ray Film.

'Kodak' Tested X-ray Chemicals: Developing and replenishing powders, fixers... are always readily available

Exposure Equipment; Intensifying screens; X-ray cassettes; etc.

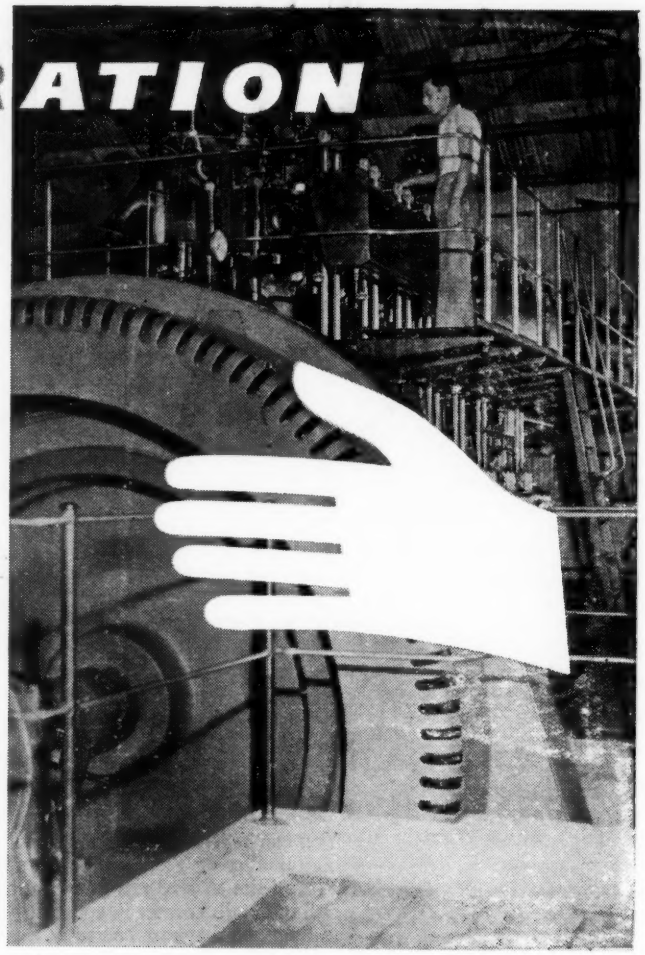
Processing Equipment; Film hangers; film clips; corner cutters; processing tanks, safelight lamps; etc.

Viewing Equipment: X-ray illuminators of various types.

JWT

COOPERATION

makes things hum in industry



New machines and techniques are revolutionising standards of lubrication in Industry. What was good enough yesterday may not be good enough today. At the same time, rising maintenance and labour costs increase the value of efficient lubrication. To meet the new demands, modern Industry requires an up-to-date and practical Technical Service based on widespread experience of the highest calibre.

Burmah-Shell are exceptionally well-placed to provide this service. They have close contacts with the world's leading machinery manufacturers. They have a variety and quality of experience unsurpassed in the lubrication and fuel application field. And they are invigorated by the stream of advanced technical knowledge which issues continually from 14 great Shell Research Centres throughout the world.

This Technical Service can be immensely valuable when applied to your problems. The basis of it is cooperation; cooperation between Burmah-Shell and the industrial engineer to find the right lubricant for every job; to apply it correctly and to make it available in standard quality. We shall be happy to cooperate with *you*.

BURMAH-SHELL *is part of progress in Pakistan*

A NEW SERVICE
OFFERED BY
PANSDOC

A number of current Russian scientific journals *completely translated into English* (" cover-to-cover " translations) are now being taken by PANSDOC; they include:—

Biochemistry
Bulletin of Experimental Biology and Medicine
Entomological Review
Glass & Ceramics
J. appl. Chem. USSR.
Soviet Soil Science
etc., etc.

Specimen Contents Lists of these journals will be supplied on request; microfilms or full-size photocopies of individual papers can be obtained at PANSDOC's usual rates.

The following established services are also offered by PANSDOC to all scientists and technologists in Pakistan, whether employed in Government institutes, in the universities or in industry:—

Document Procurement: PANSDOC will supply a microfilm or photocopy of any published paper, on receipt of an order giving full bibliographical details.

Bibliography Compilation: PANSDOC will, on request, compile a short list of references to the published literature on any special subject in the field of science and technology.

Translations: PANSDOC will, on request, supply an English translation of papers in the field of science and technology published in any language.

Charges for Services

Microfilms	.. ..	Rs. 1/- per 10-in strip (approximately 10 pages).
Photocopies	.. ..	Annas 8 per page.
Bibliographies	.. ..	Rs. 3/- per foolscap page of typed references.
Translations	.. ..	Rs. 3/- per typed page of about 300 words.

Note: It will be observed that the above charges are very low; they are in fact designed only to prevent abuse of the services.

PANSDOC

(Pakistan National Scientific & Technical Documentation Centre)
2/141/S PECHS
KARACHI

Control

of

Hypertension

with

Rauwolfin – Marker

2 mgm. and 5 mgm. Tablets

of

Total Alkaloids of

Rauwolfia Serpentina

Fine Chemicals, Tinctures and Extracts, Tablets, Injectable Solutions, Ephedrine, Pseudo-Ephedrine Hydrochlorides, Wintogeno Rheumatic Balm, Ner-Vigor—The Most Popular Tonic. British Scherings Oblivon and Neu Tradonna, Eau-de-Cologne Etc.,

Manufactured by

Marker Alkaloids and Marker Pharmaceuticals Ltd.
Quetta

Head Office

Residency Road, Quetta.
Phone : 2491.
Grams : MARKER

Branch Office

Brigstocke Eduljee Building,
Keamari, Karachi.
Phone : 35607
Grams : MARKALOIDS

Sole Agents

West Pakistan

M/s. Jamsetjee's Sons,
3, Lakshmi Mansion,
Mall Road, Lahore

Khairpur & Hyderabad Divisions

M/s. Niaz A. Shaikh & Co.
Saraffa Shahi Bazar,
Hyderabad.
Phone : 3790

Karachi Area

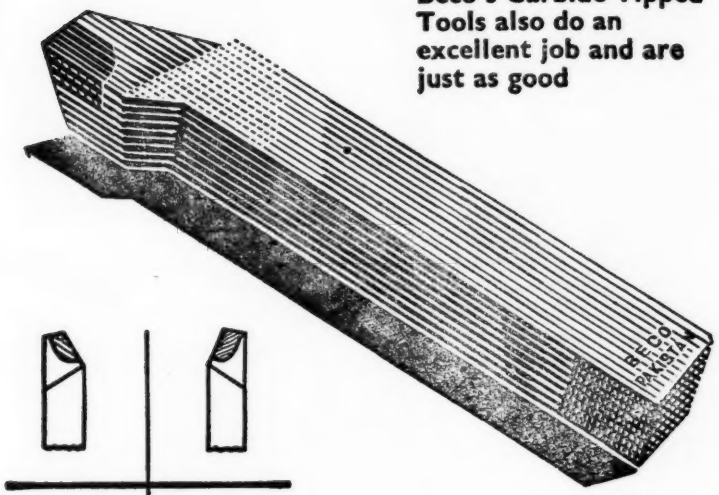
M/s. Service & Sales (Pak) Ltd.
Katrak Mansion, Machi Miani,
Karachi.
Phone : 32240
Grams : SERSALES

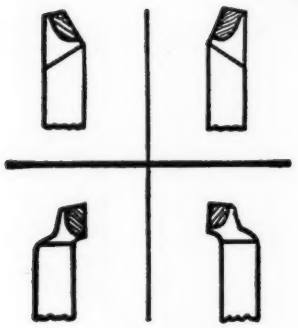
East Pakistan

M/s. Dacca Pharmaceutical
127, Motijheel Commercial Area,
Rama, Dacca.
Grams : ELAJ

Do you still use imported cutting tools?

Beco's Carbide Tipped Tools also do an excellent job and are just as good





BECO

Made of the best Carbide tips, they are sharp and lasting. For straight roughing, finishing and facing of steel, cast iron and bronze. Available in different sizes and specifications.

THE BATALA ENGINEERING COMPANY (PAKISTAN) LTD.,

THE MALL, LAHORE

BRANCHES: Dunolly Road, Karachi-2. New Cloth Market, Hyderabad. Railway Road, Multan. 16, Jinnah Avenue, Dacca. Quaid-e-Azam Road, Chittagong.

EUROPEAN DIVISION OFFICE: Hope House, 45, Great Peter Street, Westminister, London, S. W. I.

OXY-ACETYLENE WELDING

- OXYGEN
- DISSOLVED ACETYLENE

Life needs oxygen—
Industrial life needs Pakistan Oxygen

PAKISTAN OXYGEN LIMITED

CHITTAGONG DACCA KARACHI LAHORE LYALLPUR RAWALPINDI

PO

NAZER & Co.

Elphinstone Street, Speechly Compound
P. O. Box 7107
Karachi-3

35/36, Bawaney Building, Jinnah Avenue
P. O. Box 107, Ramna
Dacca

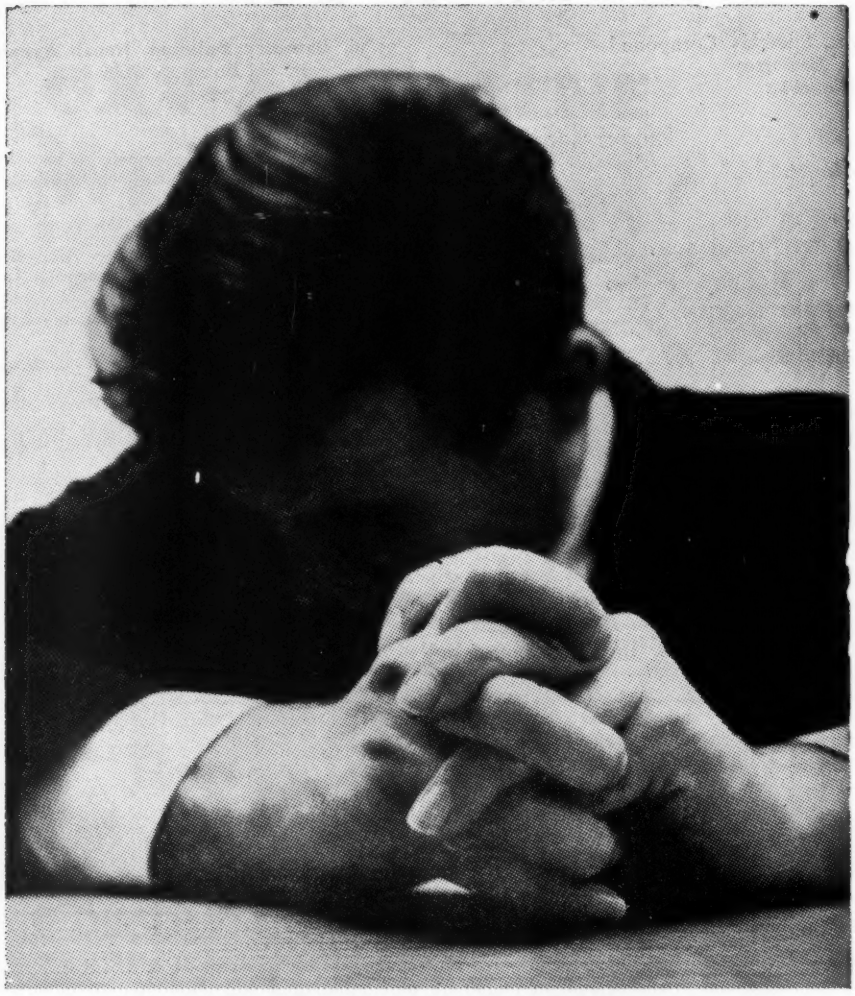
AGENTS AND DISTRIBUTORS FOR:

KARL KOLB, Frankfurt/M.	"GERMAN SCIENTIFIC SUPPLIES" Comprehensive Laboratory Equipment, Scientific Instruments.
C. REICHERT A. G., Wien	Microscopes of highest quality, Microtomes, Kofler Hot Bench.
BECKMAN-INSTRUMENTS GmbH., Muenchen and Fillertone, California, U.S.A.	Direct Reading and Recording Spectrophotometers (Ultra-violet, visible, and infra-red), pH-Meters, Colorimeter, Automatic Titration Equipment.
JENAer GLASWERK SCHOTT & GEN., Mainz	World-famous JENA Laboratory Glassware, highest possible resistance against heat and chemicals.
W. C. HERAEUS GmbH., Hanau	Laboratory Heat Treating Equipment, Quartz-glass, Platinum ware, Thermocouples.
SARTORIUS-WERKE A. G., Goettingen	Analytical and Precision Balances, Microtomes.
M. CHRIST, Osterode	Centrifuges for all Laboratory Purposes, including Refrigerated and Ultra-Centrifuges.
A. PFEIFFER, Wetzlar	Vacuum Pumps, Vacuum Gauges, Freeze Drying Equipment.
J. KOETTERMANN K. G., Haenigsen	Water Distilling Apparatus, Drying and Incubating Ovens, Climatic Test Chambers.
PHYWE A. G., Goettingen	Demonstration Equipment and Teaching aids for Physics, Chemistry Biology, Botany etc. for Universities and Colleges.
Dr. P. KRANTZ, Bonn	Collections and Equipment for Geology, Mineralogy, Geography.

Your inquiries are kindly solicited.

INDEX TO ADVERTISERS

Albert David (Pakistan) Ltd.
Ali Gohar & Company
A. Gallenkamp & Co. Ltd.
Atco Laboratories
Burmah-Shell
E. Merck
Hamdard Trust Laboratories (Pakistan)
Karl Kolb
Kodak Limited
Marker Alkaloids & Marker Pharmaceuticals Ltd.
May & Baker Ltd.
Nazer & Co.
N. Futehally & Co., (Karachi) Ltd.
Pak Chemicals Ltd.
Pakistan National Scientific and Technical Documentation Centre (PANSDOC)
Pakistan Oxygen Limited
Philips Electrical Co. of Pakistan Ltd.
Squibb (Sole Distributors: Orient Trading (Pak) Corporation, Karachi)
The Anglo-French Drug Co. (Pakistan) Ltd.
The Batala Engineering Company (Pakistan) Ltd.
The British Drug Houses Ltd.
The Malik & Co.



FOR SUCCESSFUL LONG-TERM THERAPY
IN HYPERTENSION...MENTAL TENSION...
YOU CAN RELY ON **RAUDIXIN**

Squibb Whole Root Rauwolfia Serpentina

SQUIBB

Quality the priceless ingredient.

Raudixin is a trademark

Sole Distributors:
ORIENT TRADING (PAK) CORPORATION
Hemani Mansion, Bunder Road, Karachi
Branches: LAHORE — DACCA — CHITTAGONG.

ATCO

SYNTHOMYCETINE

(Synthetic chloramphenicol of WORLD wide repute)

A most potent weapon against life taking organisms

Capsules, Syrup, 5% dermatological and ophthalmic ointment.

SYNTHOMYCETINE is an antibiotic with a broad spectrum of activity against Gram-negative, Gram-positive micro-organisms and Rickettsia. It exerts a particularly intense action on Gram-negative micro-organisms, especially Salmonella, Brucella, Shigella, Hemophilus influenzae, Friedlander's bacillus, Escherichia coli and some strains of Proteus. It is rapidly absorbed in the body and easily passes the blood-brain barrier. Its action is characteristically sustained and free from Nervous Shock and other side-effects.

Typhoid
Paratyphoid A and B
Bacillary dysentery
Pertussis
ALL DISEASES CAUSED BY SALMONELLA INFECTION
Brucellosis
Bacterial and atypical pneumonia
Meningitis caused by Gram-negative organisms
Herpes Zoster
Gynaecological, urinary, venereal, dermatologic, surgical and ocular infections, etc.

ATCO

ATCO LABORATORIES KARACHI

STRONACHS AT/408

VITAMIN B COMPLEX

Specify

BEPLEX

TABLETS

INJECTABLES

ELIXIR

Literature on Request

The Anglo-French Drug Co. (Pakistan) Ltd.
Jamshed Katrak Chambers
Machi Miani Road
Karachi-2

THE MALIK & CO.

-: دی ملک اینڈ کمپنی :-

(Scientific Department)

36, Campbell Street, G. P. O. Box No. 182

Karachi-1, (Pakistan)

Direct Importers and Stockists of

(1) **Scientific instruments and apparatus, all sorts.**

(2) **Laboratory glassware including glass tubings.**

(3) **Laboratory chemicals, reagents, indicators and stains for microscopy.**

(4) **Electrical instruments and apparatus for laboratory use.**

(5) **General laboratory equipments of miscellaneous nature.**

(6) **Machinery and equipments for dairy, poultry and bee-keeping industries.**

(7) **AEROGEN petrol-air gas generating plants and accessories.**

Complete furnishing and equipping of science laboratories, erection of gas plants, laying out of gas mains and putting up water-supply arrangements in laboratories, is undertaken by us because we specialise in this work.

WE SERVE SCIENCE AND INDUSTRY

Phone: 31441 Cable: "IMPOGEN"

Enquiries Solicited

Constant research, patience and perseverance are pre-requisites of scientific and industrial progress which ultimately aims at bringing peace and prosperity. With extensive upto-date knowledge, resources and equipment, selfless scientists strive hard to ameliorate the lot of mankind.

SERVING HUMANITY

Hamdard Laboratories—the centre of revival of Eastern Medicine — continue to perfect indigenous drugs and medicines so that humanity at large may benefit.

Hamdard

HAMDARD TRUST LABORATORIES (PAKISTAN)

Karachi Dacca Lahore

STRONACHS

ALI GOHAR & COMPANY

—: o :—

SOLE AGENTS & REPRESENTATIVES OF WORLD FAMOUS MANUFACTURERS OF:

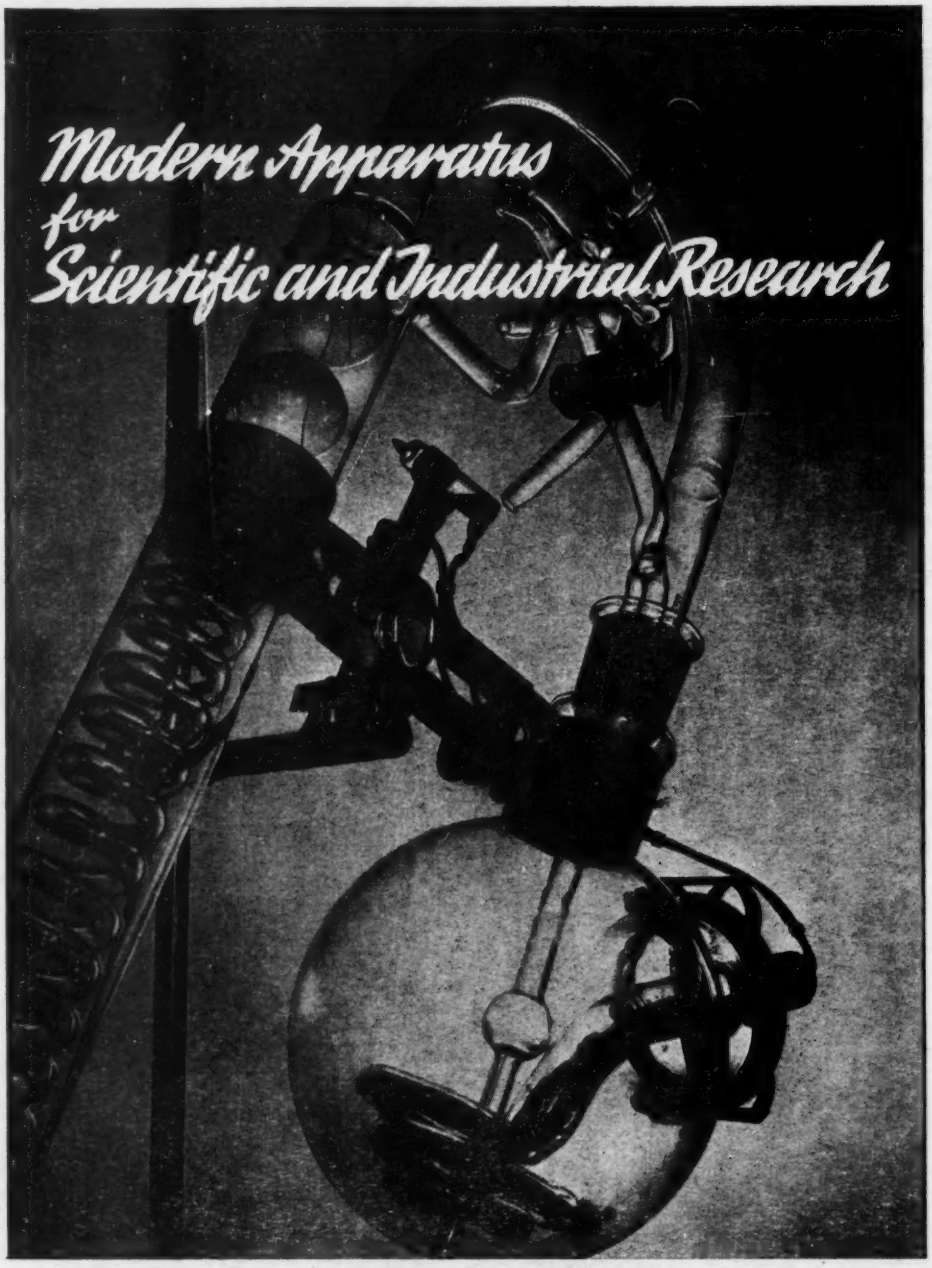
- Miscroscopes all types; Microphotographic equipment with the Leica and with plate cameras; Microtomes all types; Photometers with optical or electrical reading for colorimetry, nephelometry and fluorometry.
- Spectrographs for infrared, visible and ultraviolet ranges ; Mass spectrometers.
- Ultrasonic equipment for laboratory experiment and material testing.
- X-ray equipment for material testing, diffraction and spectrography and irradiation. Radio-activity measuring instruments.
- Optical precision measuring instruments for workshops, tool rooms, inspection laboratories etc.
- Assembly hall epidiascopes; Operation projectors; Class-room epidiascopes; Reading projectors; X-ray film projectors; Micro-projectors; Leica (miniature) projectors.
- Prism binoculars for sport, hunting and theaters; Leica cameras, lenses, enlargers, and reproduction, copying and close-up equipment.
- Culture media, laboratory preparations and sterile reagents.
- Warbrug apparatus.
- Kipp galvanometers; Drum camera; Paper camera.
- Micrograph; Moll thermopiles; Vacuum thermocouples.
- Actinometer; Solarigraph; Moll recording microphotometer; Mirror-double monochromator; Photoelectric colorimeter; Flame photometer; Fluorometer.
- Gas-analyser; Brinkman haemoreflector; Brinkman cyclops; Carbovisor.

ALI GOHAR & COMPANY

P. O. Box 3405, Serai Road

KARACHI

Tel: 35105 *Gram:* CASTOLOID



KARL KOLB
SCIENTIFIC - TECHNICAL - SUPPLIES
FRANKFURT - MAIN 1 . GERMANY

Sole Representatives for Pakistan :

NAZER & CO.
Cable: KONSULT

P. O. Box 7107
Karachi-3

P.O. Box 107
Dacca

Printed at Nazeer Printing Works, Water Course Road, Karachi.